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THE INFANT

A HANDBOOK OF MODERN TREATMENT

IN APPRECIATION OF
HIS PIONEER SERVICES
TO THE CAUSE OF INFANT WELFARE,
THIS BOOK IS
GRATEFULLY DEDICATED
TO
SIR ROBERT MOND, LL.D., J.P.
FOUNDER AND TREASURER
OF
THE INFANTS HOSPITAL,
LONDON

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PINK DISEASE.

[*Frontispiece.*

THE INFANT

A HANDBOOK OF MODERN TREATMENT

BY

ERIC PRITCHARD

M.A., M.D.(Oxon.), F.R.C.P.(Lond.)

CONSULTING PHYSICIAN TO THE QUEEN'S HOSPITAL FOR CHILDREN, LONDON; CONSULTING PÆDIATRICIAN TO QUEEN CHARLOTTE'S HOSPITAL, LONDON; HONORARY CONSULTING PHYSICIAN FOR THE DEPARTMENT OF INFANT CONSULTATIONS, ST. MARYLEBONE GENERAL DISPENSARY AND WESTERN GENERAL DISPENSARY; HONORARY CONSULTING PHYSICIAN, WELLGARTH NURSERY TRAINING COLLEGE AND BARNET HOME HOSPITAL; CONSULTING PHYSICIAN FOR SUNSHINE HOMES FOR BLIND BABIES (NATIONAL INSTITUTE FOR THE BLIND). LATE MEDICAL DIRECTOR, THE INFANTS HOSPITAL, LONDON (1922–1936), AND PHYSICIAN, CITY OF LONDON HOSPITAL FOR DISEASES OF THE HEART AND LUNGS (VICTORIA PARK) ETC., ETC.



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PREFACE

In presenting this new Volume to my colleagues of the medical profession, I think it is only fair to them, as it is fair to me, to state clearly what this book is not, quite as much as what it actually is. In the first place, though its first title, namely " The Infant," is the same as that which I gave to a little book which I wrote in 1914, its sub-title, namely " A Handbook of Modern Treatment " sufficiently explains the difference between it and its predecessor which had the subsidiary title of " Nutrition and Management " and was written from the point of view of the Welfare Centre, and as such was mainly concerned with Prevention rather than Cure. On the other hand the present volume is written exclusively from the point of view of the general practitioner, and as its sub-title explains, it is a Handbook on Treatment : but it is not a text-book or dictionary of treatment, it is a handbook for occasional reference, and from the latter point of view I hope that its very complete index will enable the reader to find quickly the information he requires.

Apart from treatment, this book has nothing whatever to do with the diseases of infants. It is in no way concerned with the description of diseases, or the courses which they run, nor has it more to do with etiology or pathology than is necessary to explain the rationale on which the treatment described is based. It contains nothing whatever about prognosis, and no more about diagnosis than will enable the reader to be quite sure when he refers to this book for information that he is looking at the right paragraph. Even as a Handbook on Treatment however, both the title and the sub-title require a little more definition. In the first place, the term " Infant " is for the purpose of this book intended to cover the first five years of life—the age limit for admission to The Infants Hospital during my time of office as Medical Director, and the period of life with which most of my pædiatric experiences have been associated.

It is, however, in no sense a collection of the many different methods of treatment taught and practised by the various authorities on this subject, both in this country and abroad, nor is it a " scissors and paste " compilation ; it is merely a selection

of those methods which I personally believe to be the best and most reliable, and of which I have had personal experience. In hardly any instance do I give more than one method of treatment, and I practically never leave it to the reader to decide which of several alternative methods he should adopt. I make the choice for him and with that, I am afraid he must rest content.

During the fourteen years I served as Medical Director of The Infants Hospital, I had unique opportunities for comparing and contrasting the different methods of treatment introduced to the practice of the hospital by my many distinguished colleagues. In this way I have been enabled to exercise an eclectic discrimination which I hope has been wisely used. While acknowledging with gratitude my indebtedness for extensive borrowings from these sources, I would at the same time point out that many of the methods described in this book are both new and original; and by new methods, I mean of a kind which although possibly taught and practised by myself for many years, still remain inaccessible to the majority of those who will use this book; and by original, I mean methods which are entirely my own.

The sections of this book which come under one or other of these categories include the following, namely, the treatment of Cœliac Disease without the exclusion of fats from the diet; the treatment of the Communicating type of Hydrocephalus by dehydration; the intensive Creosote treatment of Tuberculosis, and the prophylactic treatment of the same disease in young infants by immunization with Koch's Old Tuberculin; the treatment of obstetric fractures in the new-born without splints; the treatment of premature and debilitated new-born infants by thyroid medication; the treatment of Pigeon Chest by a specially devised apparatus; the use of Tannic Acid in the treatment of sore buttocks, and of Monsol in Thrush.

This combination of what is old with what is new, has interfered very considerably with the uniformity as regards length of the various sections of the book. I dismiss in as few words as possible old and familiar methods, but give a full account of the methods which are new.

The general arrangement of the various pathological conditions included in this book, has, I must admit, given me a good deal of anxiety. When I started the revision I hoped to arrange the material on a basis of etiology, but I had to abandon this intention, and fell back on one which is based neither on etiology nor on "systems," but on a combination of the two. This defect in uniformity of arrangement is perhaps of less importance owing to the fact that readers will probably not peruse the different

sections of this book consecutively, but use it only as a work of reference.

This book has been written very largely in response to the repeated requests I have received from those who have attended the post-graduate courses on the care of infants which I have given at the various institutions to which I have been attached during the last thirty years. I am afraid, however, that the fulfilment of my oft-repeated promise to accede to these requests and provide a permanent record of my teaching will come too late to be of much service to some of those who attended the earlier courses. I hope, however, in the added experience to which this delay has contributed, there may be some compensations. These lectures date back as far as the year 1906, when I was in charge of the Welfare Centre at the St. Marylebone General Dispensary. Between 1909 and 1922 I gave various short courses at The Queen's Hospital for Children, but most of these lectures, at any rate in the form in which they appear here, were given between 1922 and 1936 at The Infants Hospital in connection with the Fellowship of Medicine and the London Public Medical Service. As I never gave less than three such courses in a year, and inasmuch as each course consisted of at least twelve lectures, the total number of these lectures must have amounted to at least 1,500. Much of the present volume represents almost a verbatim report of the parts of these lectures which are concerned with treatment, as no doubt many readers will recognize. I can only hope that on the shelves of new friends and new readers this record of my oral teaching will find opportunities for usefulness.

Although of recent years many of my demonstrations were held in the wards or in the Out-patient Department of The Infants Hospital, most of the actual lectures were given in its beautiful lecture room, which has been for so many years my inspiration and delight, and the attractions of which as a rostrum for teaching certainly contributed largely to my acceptance of the post of Medical Director in 1922. This lecture room with its exquisitely carved panelling, its fretted roof, and its delicately traced lattice windows, was presented to The Infants Hospital by Sir Robert Mond, the founder of the hospital, to whom in grateful appreciation of his many services to the cause of Infant Welfare, I have dedicated this book. This lecture room was given by him to the hospital in memory of his first wife, and to use his own words—"as a psychological experiment to see how far the genius of beautiful surroundings could influence the words of the lecturer, or the reception given to them by his audience." In a way this book

is an answer to part of this question, but not I fear exactly in the manner or in the sense that Sir Robert hoped or expected.

In conclusion, I wish to record my sincere thanks to Dr. Morris Witkin, of Johannesburg, who has placed his unique experience in the reading of pædiatric manuscript at my disposal. He has examined the whole of the typescript of this book, and has made many useful comments and criticisms, for which I am extremely grateful.

I also wish to record my thanks to my Secretary, Miss W. K. Gibson, for the unfailing assistance she has been to me in the preparation of this book.

ERIC PRITCHARD.

HARLEY STREET,
LONDON, W.C.

CONTENTS

CHAP.		PAGE
I	Nutrition: The Principles of Physiological Feeding	1
II	Breast Feeding	14
III	Artificial Feeding of Infants	33
IV	Feeding of Children from One to Five Years of Age	64
V	Nutritional Diseases due to Dietetic Faults and Deficiencies	85
VI	The New-born Baby, including the Premature Infant	120
VII	The Alimentary System	170
VIII	Diseases of the Respiratory System	229
IX	Diseases of the Heart and Blood-vessels	282
X	Diseases of the Blood	304
XI	The Genito-urinary System	330
XII	The Endocrine System	356
XIII	Infective Diseases	385
XIV	Diseases of the Skin	455
XV	Diseases of the Nervous System	530
XVI	Diseases of the Skeletal System and Joints	585
XVII	Deformities and Diseases of the Muscular System	615
XVIII	Diseases of the Eyes and Ears	637
XIX	Casualties and Minor Accidents	667
	Appendix:	
	Part I. Prescriptions and Pharmacological Preparations	685
	Part II. Technique of Clinical Procedures	711
	Index	728

LIST OF PLATES

Coloured Plate		Pink Diseases	*Frontis*
Plates			Facing page
I and II.	Fig. 12.	Fractured femur in new-born infant .	150
	Fig. 13.	Deposition of callus at end of third week	
	Fig. 14.	Resumption of normal shape at 5½ months	
	Fig. 15.	Complete recovery of shape at 10 months	151
Plate III.	Fig. 16.	Congenital pyloric stenosis . . .	178
Plate IV.	Fig. 17.	Hirschsprung's disease . . .	202

THE INFANT

CHAPTER I

NUTRITION: THE PRINCIPLES OF PHYSIOLOGICAL FEEDING

The Meaning of the Term—Nutrition

Unfortunately, we have no real standards by which we can usefully estimate degrees of nutrition, good or bad. Indeed, the term itself is often very loosely applied to certain external appearances by which we judge various degrees of bodily health. For instance, an individual is sometimes described as being in a condition of excellent nutrition simply because he is fat and sleek in appearance. As a matter of fact, neither size, weight, nor rate of growth are criteria of good nutrition. Fat infants are often thoroughly unhealthy; they may be on the verge of a serious breakdown for all their good appearance: whereas thin wiry infants may often be in the robustest of health and extremely resistant to disease. There is no stronger or healthier man in the world than the typical Australian backwoodsman, yet he probably has not an ounce of superfluous fat on his body, and he may be angular and skinny in appearance, and give one the impression of being half-starved. In fact the state of nutrition of any individual can no more be judged by external appearance or weight than can the intrinsic qualities of a watch or motor-car be estimated by any superficial examination. The qualities of watches or motor-cars reside in the reliability and efficiency of their machinery. And so it is with the animal machine, its so-called state of nutrition can only be gauged by the manner in which the functions of digestion, absorption, assimilation, energy production, and disposal of waste products are carried out. Nutrition ought to be regarded as a very comprehensive term which includes all these and many other functions, and when we speak of degrees of nutrition in any individual we should really refer to " end results "—*i.e.* to his capacity as a machine to carry out the physical functions of life.

The animal machine has one very obvious advantage over any other machine yet devised, in that, unlike the ordinary mechanical machine, it is unnecessary to attend to all its wants separately, to put its fuel, lubricating oil, water, battery ingredients, or anything else that is required for keeping it in running order, into separate compartments or receptacles; for in the case of the animal machine everything that is required for keeping it in working order and repair can be supplied in the form of food and poured into one aperture, namely, the mouth. It is clear, therefore, that in order that the machine may work efficiently and well, in other words, be in a state of good nutrition, the individual must be supplied with food which contains the large number of different constituents required for growth, repair, heating, lubricating, cleaning, cooling, and for a number of other functions. Further, if the best and most economical results are to be attained they must all be given in certain definite quantities. This food, which is usually supplied in a crude or raw state, must be prepared, simplified, and liquefied by the processes of digestion, so that it may be absorbed into the blood stream, sorted out, and utilized in a variety of different ways; and finally, all waste products must be got rid of and excreted from the body.

In this chapter I do not propose to deal with matters relating to digestion, absorption, utilization, or excretion, but to confine my remarks to the supply of all the many food elements which are essential for the running and working of the animal machine.

Artificial Feeding should be founded on the Principles of Natural Feeding.

Many years ago I was criticized for applying the term " physiological " to any method of feeding except breast feeding, for it was claimed that no method could be " physiological " (physis = nature, and ology = science), which was not natural, and that breast feeding was the only system which truly deserved to be so described. Although I concede the partial truth of this generalization I submit that any system of feeding which is founded on natural principles, or aims at reproducing or imitating the natural method, has some claims to the title " physiological."

The principles on which all good methods of artificial feeding should be based are the same in kind as those of natural feeding, although I must admit that no artificial system can ever be in all respects as good as breast feeding. The best method is that which most closely resembles breast feeding, and the more any system departs from this standard, the worse it probably will be.

A Complete Food consists of many Different Constituents.

Substitutes for breast milk have been compounded from time immemorial of food substances which in the light of existing knowledge have been believed to possess the same nutritional properties as breast milk itself. The reason why most of these methods have fallen so short of the ideal aimed at is that the real chemical composition of milk itself has heretofore been so little understood. Milk contains something like forty different constituents. There are certainly six different vitamins in milk, and more than a dozen different mineral constituents, without mentioning all the different kinds of fat and fatty acids, and the various proteins, extractives, aromatic and colouring matters, most of which have some nutritional significance.

In view of this multiplicity of the constituent elements of human milk it is quite understandable that any person trying to compound a substitute is liable to make mistakes and omissions. Each one of the many constituents of milk has, so to speak, a different nutritional value, and each of them plays some part in the maintenance of health, and cannot be entirely dispensed with if the best results are to be expected. Death will follow, sooner or later, if any of the more important of these elements is entirely omitted from the dietary, and nutrition will suffer to some degree, sometimes soon and sometimes late, if there is any great disparity between the optimum amount required and the amount actually given.

The best results will only be obtained if the optimum amount of every one of these food constituents is provided. For instance, if so important a food factor as vitamin C—*i.e.* the anti-scorbutic element—is entirely omitted from a baby's diet, death will inevitably ensue from scurvy, a disease which will manifest itself by its characteristic symptoms, possibly within three months, possibly earlier, but if this vitamin though present in the food, is present in too small an amount, death will not result, but the general standard of nutrition will be lower than it would otherwise have been.

Comparable results follow from complete absence or deficiency of most of the other essential elements of a dietary, but at the present time with our somewhat limited knowledge and means of examination, it is not always easy to ascribe the symptoms to their particular causes, or as is often the case, to the exact combination of several different causes. It is true that at the present time we do know something about the clinical evidences which are to be expected from uncomplicated cases of deficiency of vitamins A, B, C, and D, and also something about the symptoms

due to deficiencies of iron, calcium, iodine, phosphorus, and sodium chloride, but it is often extremely difficult to interpret the results of deficiencies of several of these necessary elements in combination. I only mention these fundamental facts in order to point out that sound nutrition is not only dependent on the supply of an optimum amount of a few food substances such as protein, carbohydrate and fats, but on a great many other things, and that all of these are not only supplied in human milk, but are also approximately supplied in the right proportions.

Essential Elements are Missing from the Majority of Dietaries.

The unsatisfactory results in nutrition which are only too obvious in the adult population in almost every country in the world, as well as in our own, are very largely due to some failure in the national dietary to provide for all these many essential food requirements. Difficult as it is to find a satisfactory substitute for human milk, it is still more difficult to compound a dietary for older individuals so balanced as to contain all the required food elements in optimum amount. Certain essential elements are almost certain to be excluded from any haphazard mixture of the natural foods which local, climatic, and economic conditions make imperative. An absolutely correct balance with respect to all the necessary elements is a consummation which however greatly to be desired is at the present time almost impossible of human attainment. No national dietary has ever yet been devised which completely fulfils the required conditions and is capable of standing the test of modern scientific criticisms. They are all wrong in some respect or in some degree, and some of them to a very large extent. Dietaries are, however, greatly improving, but some of us who take an interest in these matters would like to see the pace of progress a little accelerated.

In this country we are just beginning to understand that the dietary of the toiling masses in our crowded centres of population lacks vitamin and mineral elements, chiefly from the limitation in the consumption of milk, fruit, and vegetables, the main sources of supply of these elements, and also from the excessive consumption of white bread, meat, margarine, sugar and cereals, which are ill-provided with them. In Switzerland where the diet contains an abundance of milk, fruit, and vegetables, there is, or at least used to be, a serious shortage of iodine, both in the soil and in the food. Hence, until this deficiency was made good by the compulsory addition of iodine to table salt, there was a great prevalence of those particular deficiency symptoms which depend on a shortage of iodine, namely, those of goitre, myxœdema, and cretinism. The story is the same all the world over at the present

day. With the extension of scientific and dietetic knowledge, reforms are constantly being introduced into almost every national dietary, and with the rectification, time-honoured mistakes and many century-old diseases are rapidly disappearing, but as I have already indicated, the pace of these reforms does not keep up with that of the growth of scientific knowledge.

I may therefore summarize the first principle of physiological feeding in the following terms :

> For the maintenance of sound nutrition a very large number of different food substances, including vitamins and mineral elements, are required—about forty in all, and for optimum nutrition these same elements must be supplied in optimum amount.

The Uses of the Different Food Elements

Fuel Foods. It is impossible within the limits of the space I have allowed myself to mention more than a few of the properties and purposes of all the various elements required in a complete dietary. The fuel substances, namely, the proteins, carbohydrates, and fats are required as sources of energy, and heat, and the total amount required of these foods will depend on the amount needed to provide for the output of work, and the maintenance of temperature. This amount will necessarily vary with habits of life, occupation, climate, clothing, and a number of other factors, but in the case of infants the requirements are fairly constant, provided that the infants are themselves normal. Average babies of the same weight and age generally take about the same amount of exercise and are mostly clothed and housed in a similar manner.

It is usual to estimate the fuel requirements of a baby by its age or weight ; it does not matter which criterion is taken in the case of a normal baby, the result is the same whichever way the calculation is made, but weight is the simpler and easier factor to deal with. If we accept weight as a criterion, the total amount of fuel required by the baby can be arrived at by multiplying its weight in pounds by 50. This will give the number of Calories or units of heat required in the 24 hours. Thus a normal baby four months old, and weighing 12lb. will require 12×50 or 600 Calories in this unit of time. A similar result would have been arrived at by referring to a table giving the requirements of normal infants of different ages. In such tables it would be found that a four-months-old baby requires 600 Calories in the 24 hours, because normal babies weigh 12lb. at this age, and $12 \times 50 = 600$.

It must be remembered, however, that such estimates only apply to normal babies. If babies are over-weight or under-weight, or otherwise abnormal by reason of sickness or physical disability, corrections and allowances have to be made for such disturbing factors. For instance, premature babies are abnormal babies. They are of abnormal weight for their age, and hence allowances have to be made with respect to their Calorie requirements, and it is usual to allow between 60 and 70 Calories per pound of body-weight of the baby instead of the 50 allowed for normal infants.

The fuel foods, proteins, carbohydrates and fats, produce on combustion within the body the following number of Calories or units of heat per ounce of weight.

1 oz. of protein produces 116 Calories on combustion.
1 „ „ fat „ 263 „ „ „
1 „ „ carbohydrate produces 116 „ „ „

It is not a matter of indifference, however, which variety of fuel food is selected for the supply of the required number of Calories. It might be supposed that these requirements could be supplied by one variety or by any combination of the varieties in adjusted amounts, but as a matter of fact to get the best nutritional results the total number of Calories must be provided by all three varieties of fuel foods in certain more or less fixed and definite proportions. As far as the baby is concerned the best proportion in which they can be supplied is the ratio or balance in which they are represented in human milk, which is as follows :

Proteins	1·5 per cent
Fats	3·5 „
Carbohydrates	6·5 „

that is to say, roughly in the proportion of 1, 2, and 4. This may not be, however, the optimum ratio under special circumstances, and in special cases, for it must be remembered that these fuel foods have other uses in the body besides serving as sources of heat and energy, for instance, they have to serve as material for growth, and for the elaboration of secretions. It is fortunate that Nature has fixed these proportions quite definitely for the normal baby, and for the young of other animals, in the milk which is supplied by the mother of each species.

1. The Uses of Proteins. Were proteins only required as a fuel they would probably be provided in the milk in very limited amount, because proteins are expensive fuel foods, both in an economic and in a physiological sense. Most proteins are difficult to digest ; they are none too easy to assimilate ; they are some-

what slow to burn; and the products of their combustion are difficult to eliminate. But proteins are highly essential for growth purposes—the basis of all protoplasm and all tissues is protein, and hence a considerable amount of this element is always required for growth and repair. The more rapid the growth, and the greater the waste of tissue, the larger is the amount of protein required to satisfy these requirements. The human baby as compared with other young mammals grows slowly, and therefore its requirements for protein elements are small—hence the low percentage, namely, 1·5 in human milk, and the high percentage, namely, 4 per cent in cow's milk, which is intended for the nourishment of the quickly growing calf.

In speaking of proteins it must be remembered that different forms of proteins have their different nutritional values. The biological value, as it is called, of the proteins present in the various kinds of animal and vegetable foods differ considerably. As far as an infant is concerned, a combination of proteins is essential. The proteins present in human milk have for the human infant a higher biological value than proteins from other sources. Therefore, if the proteins of cow's milk are substituted for the proteins of breast milk they must be provided in somewhat greater quantities, and indeed at greater physiological cost.

2. The Uses of Fat. As for the fats, these have most important functions to perform in the animal body besides serving as fuel. Fats in the case of the infant are the sole source of supply for vitamins A and D, that is to say of the two fat-soluble vitamins. A baby can obtain neither of these from those other sources which are available for the adult. It is therefore essential not only that the infant should obtain an adequate quantity of fat, but that the fats themselves should contain a sufficient amount of vitamins. Vegetable fats contain practically none, whereas Cod-liver Oil and Halibut-liver Oil both contain very large amounts. Butter fat in human milk and cow's milk contains a fair quantity, but not sufficient for the total requirements when the infant has a restricted amount of cream. Fat is also required for the growth of the myeline sheath of the nerves. It is also the sole source of "roughage." Adults depend on cellulose and other fibrous matter derived from fruit and vegetables for the supply of roughage. The baby who consumes neither fruit nor vegetables has to depend on soap as the solid basis of its stools, and soap can only be derived from fat. A very considerable proportion of the fat which babies consume is utilized for the formation of insoluble soaps, which constitute from 30 to 60 per cent of the dried residue of the stools. So that quite apart from its function as a fuel,

fat is required in considerable amount for other purposes. It must not, however, be given in larger amount than is required for these objects, for although fat itself is not particularly indigestible, it certainly interferes with the digestion of other food elements.

3. The Uses of Carbohydrates. Carbohydrate food, in the soluble form of sugar (milk, cane, malt sugar, etc.), is in all respects the cheapest and most economical form of fuel. In its soluble form it is easily digested, easily absorbed, easily burned, and the products of its combustion (CO_2 and H_2O) are easily disposed of. Insoluble varieties of carbohydrates are not quite so readily digested by the young infant, but are very easily digested at a later date. Taking into consideration the difficulties which the digestion of protein involves, and the impediment which fat introduces into the digestion of other food elements, it is clear that the total supply of fuel food should, as far as the interests of digestion are concerned, consist as largely as possible of carbohydrate matter. The correct proportions of the three different varieties of fuel have been determined by Nature, and are represented in human milk as above stated, namely in the proportion, roughly, of 1 of protein, 2 of fat, and 4 of carbohydrate.

When we make use of the term " balance " in its relationship to feeding, we generally refer to the ratio or proportion between the three fuel constituents. Personally I think that when we speak of " balance " in any dietary it would be more logical if we allowed the term to apply to the balance between all the many constituents rather than to restrict it to the balance between the three " fuel " foods, for within limits it is just as important to maintain a correct balance of the mineral and vitamin constituents as to maintain the balance between these three fuel constituents.

The Uses of Vitamins. With respect to the rôle which the vitamins play in nutrition we have whole volumes of information. They have no fuel or energy value, yet in some obscure way they are capable of directing and controlling growth, expenditure of energy, and the activities of certain organs. What we do know definitely is that in the complete absence of any of the essential vitamins very definite symptoms arise which ultimately cause death, and further, that with a restricted supply, that is to say, a supply below the physiological minimum, nutrition is affected in some degree, though often with somewhat indefinite symptoms. Thus there may be no increase in weight, while normal development in certain directions is arrested. I do not propose to give here any detailed account of the various deficiency diseases, but

I would briefly mention that the diseases xerophthalmia, beri-beri, scurvy, and rickets, are due respectively to deficiencies of the vitamins A, B, C, and D, and that indefinite symptoms of malnutrition, so-called "larval" deficiency diseases, arise from minor degrees of deprivation of one or more of these accessory factors.

The Uses of Minerals. The part which the mineral elements play in nutrition is a very important one, though as a rule this point is not sufficiently appreciated. It is perhaps hardly necessary to refer to the rôle which a deficiency of calcium plays in the etiology of rickets and spasmophilia. A deficiency of iron ultimately leads to anæmia, a deficiency of sodium chloride to achlorhydria, while a deficiency of iodine leads to goitre, cretinism, or myxœdema. A deficiency of bicarbonate of soda or other alkaline salts leads to acidosis. And so it is with every one of the other mineral elements which are normally present in milk, and which in some degree or other is concerned in the maintenance of normal nutrition.

With badly balanced dietaries, and especially when cow's milk dilutions are substituted for breast milk, such deficiencies are quite certain to occur. Deficiency is always present when cow's milk diluted with water without compensation is employed as a substitute for breast milk, for the reason that although the total mineral content of cow's milk is much greater than that of breast milk, nevertheless, there is not sufficient iron in cow's milk to compensate for the dilution, and the same is true of other minerals. In fact, infants fed on the usual half-and-half cow's milk dilution are deprived of something like 50 per cent of their just rights in respect of the majority of the mineral elements.

The Uses of Extractives. The part played by the various extractives present in milk and other complete dietaries is a little less definite but there can be no doubt that many of them, such as lecithin and cholesterol, are almost indispensable elements for sound nutrition. It is usual to apply the term "accessory factors" to the vitamins alone, but in view of the equal importance of mineral elements and certain extractives it seems to me more logical to allow the term to cover all the constituents in a complete dietary excepting the three fuel foods—the proteins, carbohydrates, and fats.

For sound nutrition it is necessary that the correct physiological balance of vitamins, mineral elements, and extractives should be maintained as well as the balance between the fuel elements. It must be remembered, however, that the correct balance of these many food factors is not the only condition

essential for the maintenance of health, other factors are also involved. For instance, the food consumed must be properly digested, or otherwise it can neither be absorbed nor utilized. Moreover, it must be suitably distributed with proper intervals between feeds, and further it must not be contaminated by injurious or foreign matter—as for instance with living bacteria which are capable of exciting infectious disease. Even if all these many conditions are satisfactorily complied with, there is still the possibility that nutrition may be upset by a great number of organic or functional diseases connected with the respiratory, circulatory, secretory, and excretory systems. In this chapter I cannot refer to all these eventualities, and I shall confine myself to a few brief remarks on the subjects of digestion, times of feeding, and the sterilization of food, all of which are important factors in the maintenance of sound nutrition in infants.

The Factor of Digestion

Digestion is concerned with the resolution of highly complex food substances, some solid, some liquid, into simpler forms which can be carried by processes of diffusion, osmosis, or special vital activity into the blood channels. It is true that infants can only take their food in fluid form, but as soon as the colostrum period is past, the digestion of solid food begins in that the liquid caseinogen of milk is converted by the gastric juice into a solid curd. Different kinds of solid food are rendered liquid, and different kinds of liquid food are simplified by one or other of the several digestive juices which are poured into the alimentary tract.

Gastric juice possesses very powerful solvent properties on protein foods such as casein or meat, and converts them into liquid peptones, whereas saliva, pancreatic secretions, and succus entericus contain powerful diastatic ferments which can liquefy solid varieties of starch and convert them into soluble sugars. The pancreatic secretion contains a fat-splitting ferment (steapsin) which can break up neutral fats into glycerine and fatty acids. Fatty acids subsequently unite with sodium or potassium to form soluble soaps which can pass through the bowel-wall with comparative ease. Or the same fatty acids can unite with calcium or magnesium to form insoluble soaps which serve as " roughage."

It will thus be seen that the carrying out of the functions of digestion in the alimentary canal depends on a chain of connected and associated processes, which enable otherwise solid or indiffusible foods to change into liquid, and diffusible fluids which can enter the blood stream and thus serve the purpose of nutrition.

When once the digestive processes have been fully established no ordinary food substance can escape disintegration.

The correct feeding of infants involves the principle that not only must all the varieties of food which are given to them be capable of being properly digested, but also that those varieties of food must be given which evoke the latent functions of digestion, for in this way only can the development and education of the organs of digestion be ensured. This means that the food given to infants must not be too digestible or too indigestible.

The Number of Feeds

As regards the total number of feeds, and the intervals between them, it is clear that as the nutritive material in the blood is used up by the various organs and tissues in the exercise of their several functions it ought to be replenished by the absorption from the bowel of further products of digestion. There are in the body a number of automatic mechanisms designed to ensure within limits a definite degree of concentration in the blood of the many different food elements required for nutrition. It ought to be a principle of physiological feeding to assist these automatic mechanisms as far as possible by ensuring that the rate of supply of food corresponds with the rate at which it is used, so as to lighten their task and to prevent undue strain.

The solution of the problem of finding the optimum intervals between feeds is complicated by a number of difficulties. If the intervals are too long the feeds may have to be so large as to over-distend the stomach. If the intervals are too short, the stomach may not have time to empty itself before another feed follows, and consequently have inadequate opportunity for recovery.

Fashion and practice with respect to the number of feeds which should be given in the 24 hours is constantly changing. At the present time it seems generally agreed that the number of feeds should not exceed six in the 24 hours, and that there should be one long interval during the night, which will guarantee complete emptying of the stomach and a long period of rest.

My own personal experiences incline me to the belief that during the first few weeks of life the intervals between feeds should be 3 hours during the day and the total number in the 24 hours six, and that this arrangement should be started from the time of the first feed onwards and firmly adhered to, so that habits of regularity may be impressed on the functions of digestion in the baby, and on the functions of milk secretion in the mother. At the end of the first month, if thought desirable, the intervals between

feeds may be extended to 4 hours, and the total number of feeds reduced to five, without greatly disturbing the periodicity.

The Sterilization of Food

The time-honoured belief in the virtues of raw milk for the feeding of infants still survives in certain quarters, in spite of all the scientific evidence which proves that such virtues are quite illusory. It is perhaps unnecessary to point out that since dried milks, which are of course cooked milks, have largely superseded dairy milk—for the most part raw—in the feeding of infants, the Infant Mortality Rate in this country has steadily fallen. There are naturally many other factors besides the mere cooking of milk concerned in this highly satisfactory result, but it is quite certain that if the heating of milk seriously impaired its nutritive qualities this result would never have been achieved. The effect of heat on the nutritive properties of the various elements contained in the milk is insignificant, excepting in the case of vitamin C, the anti-scorbutic element, which undoubtedly deteriorates under the influence of heat and oxidation, but since an independent supply of this vitamin is invariably provided in all cases of artificial feeding, this is no argument against the use of sterilized milk if sterilization has independent advantages. As regards this latter point there cannot be two opinions. The greatest danger that exists for young infants is infection, and there can be no question that raw milk is the most prolific medium for the conveyance of infection. No matter how many infective organisms may be present in milk they are entirely destroyed by sterilization, and it has yet to be proved that the presence of dead organisms or the products of their activity in milk exercises any harmful influence on those who consume them.

It is sometimes stated that heating has some obscure detrimental influence on the nutritive properties of milk by loosening or dissolving certain chemical affinities which are of benefit to nutrition. There is no proof whatsoever that there is any truth in this belief. Moreover, if such useful chemical affinities existed they are resolved far more drastically under the influence of the digestive processes than would possibly result from prolonged heating.

I regard it therefore as a principle of considerable importance in the artificial feeding of infants that their food, whatever be its nature, should be adequately sterilized before consumption. It makes very little difference what form the sterilization takes, as long as it is effective. Pasteurization is satisfactory, but generally difficult to carry out in the home, while commercial pasteuri-

zation usually allows opportunities for subsequent contamination during transit or after delivery. The processes of sterilization should be carried out either immediately before the food is consumed by the infant, or if this is not possible, steps should be taken to ensure that no subsequent contamination can occur after sterilization, as for instance by the use of the Soxhlet Sterilizer.

CHAPTER II

BREAST FEEDING

Although breast feeding can be, and usually is, superior to any artificial method, it is by no means fool-proof. Nature appears to have included in her method of feeding every reasonable safeguard to protect the infant from human incompetence and ineptitude, but it is obviously impossible to provide in advance for every possible contingency. Good breast milk certainly contains every one of the many different elements which are necessary for the maintenance of sound nutrition, but it is not given to every woman to secrete milk of first-rate quality. By reason of her own personal ill-health, or through faults in the dietary, the milk may be defective in respect of certain of its constituents. Again, as regards quantity, although in its own appetite and in its capacity to stimulate secretion an infant has some automatic control over the supply of breast milk, nevertheless little reliance can be placed upon the accuracy of this means of regulation. For breast feeding to be a complete success there must be supervision both of the mother and of the child.

The Establishment of Lactation

During the later months of pregnancy the mammary glands develop and enlarge under the stimulating influence of circulating hormones, but no secretion of actual milk takes place until about the third day after the birth of the infant, when the final touch is given to the secretory function by the direct stimulating influences afforded by the infant's lips. Previous to this stage there is a scanty secretion of a highly nutritious fluid called colostrum, which has very valuable properties for preparing the stomach and the digestive functions of the infant for the duties which will be imposed upon them when he obtains true milk from the mother. The amount of colostrum is very limited at first. As a rule there is no more than half an ounce in the first 24 hours, and often not more than 1 oz. in the next 24 hours, but rising in quantity to 2 to 3 oz. or more during the third day, when there is usually a change over to genuine milk. The transition from

small quantities of colostrum to larger quantities, and finally from colostrum to milk, allows time for the stomach to develop its latent digestive functions. It is of the utmost importance that this organ should learn how to carry out these functions in a well-ordered and efficient manner, and colostrum is well designed to fulfil these requirements both by reason of quality and amount. Although colostrum is a very concentrated and highly nutritious secretion, it requires no digestion on the part of the infant. It is ready for direct absorption into the blood without any preliminary change in its composition or character. Colostrum is in fact a pre-digested food, and is very little different from blood, except that it contains no red blood corpuscles. It is in fact practically the same food as that on which the infant has subsisted before birth—namely, blood plasma—the only difference in its mode of entry into the body being that before birth it enters directly into the umbilical vessels through the placenta, while after birth it has to take the somewhat more circuitous route by way of the mouth, stomach, and intestines, and thence after absorption, through the portal system to the general circulation. By these means the infant is protected immediately after birth against any radical change in the character of its food.

As already mentioned, colostrum is a very concentrated food, although it is supplied in very small amount. The following is its average composition during the first and second day.

TABLE I

AVERAGE CHEMICAL COMPOSITION OF COLOSTRUM

Day of Life.	Fat %.	Protein %.	Sugar %.	Ash %.
First	2·59	9·75	2·75	0·408
Second	2·17	7·45	3·50	0·340

Its high protein content is interesting and possibly explicable on the grounds of the presence of protective and immunizing bodies derived from the mother's blood. It is supposed that these substances are secreted in combination with globulins which constitute the major portion of the total protein.

The Number of Feeds.

The number of feeds and the length of time the infant should be allowed to remain at the breast at a single feeding during the colostrum period, are very important from the point of view of the ultimate success of breast feeding. If the infant is put to the breast too often, or allowed to suckle for too long at any

individual feed, there is some danger of the mother's nipples becoming sore and excoriated, leading possibly to the development of a mammary abscess. On the other hand, it is so important to establish regular and rhythmical habits of digestion in the baby and of secretion in the mother, that the infant should be put to the breast from the very first at the precise times which will permanently be adopted. There is a time-honoured tradition that the mother should not be disturbed by feeding her baby until she has recovered from the exhaustion of childbirth, but as a matter of fact it does not exhaust the mother if the infant is put to the breast for a few minutes, even within the first few hours after birth, as any mother will testify who gives this method a trial. Full advantage should be taken of the natural instinct possessed so strongly by the new-born infant to suck any object which is put into its mouth, by giving it an opportunity to do so at the earliest possible moment. If this golden opportunity is lost by waiting from 6 to 8 hours, it may not return. Personally, I believe that it is better for the new-born infant to be fed three-hourly during the day, with a long interval at night, than in any other way. If the periods between feedings are too long, the stomach may be overfilled, and a habit of vomiting established, whereas if the infant is fed too often it may lose the incentive of hunger to suck strongly and vigorously. My recommendation therefore is that new-born infants should be fed from the first three-hourly, and that there should be six feeds in the 24 hours at the following times, *viz.*: 6 a.m., 9 a.m., 12 midday, 3 p.m., 6 p.m., 9 p.m., and that the first feed should be given at one of these times as soon after birth as possible.

The infant should not be allowed to suckle for more than 2 or 3 minutes at each breast at first, though subsequently the time may be increased gradually until by the end of the third day it may be allowed to remain at each breast for some 5 minutes.

The Change from Colostrum to Milk.

On or about the third day the breasts usually become engorged, and sometimes painful and knotted, events which herald the actual change of the secretion from colostrum to milk. These changes are sometimes accompanied by a rise in temperature in the mother, the so-called "Milk Fever." This, however, is no contra-indication to the continuance of breast feeding.

The Quantity at each Feed.

It is no more possible to manage breast feeding successfully without measuring the quantity of milk which the infant receives than in the case of artificial feeding itself. Breast-fed infants sometimes obtain a great deal more milk than is good for them,

and this is particularly the case at the time of the establishment of lactation proper, at or about the third day. It is very important to provide against this contingency, as the habit of vomiting is very easily established at this time. On the other hand, breast-fed infants often obtain far too little milk, and this is specially likely to occur when the mother gets up, or later at the fifth or sixth month. The only way to avoid these errors is to measure the amount of milk the infant obtains by means of the "test feed"—that is to say, by weighing the baby before and after the feed on accurate scales [1] which will weigh to one drachm.

The details to be observed in test feeding are as follows: the infant should be wrapped in a loose shawl with all its clothes on and its napkin in position, so that if during the feed urine or a motion is passed this will not interfere with the accuracy of the weighing. A careful record should be kept of the results of the weighings for future reference. With very little practice and experience a mother or nurse can soon learn how long an infant should be left at the breast to take the required amount. It is seldom necessary to leave the infant for longer than 7 minutes at each breast, indeed if it does not get the required amount in this time it is better to take the child away from the breast and make up the deficiency with some complementary food—either milk which has been expressed, or some artificial substitute. A good deal can be learned about the infant's capacity for sucking and the capacity of the breast for supplying milk if what is called a "differential test feed" is given. By this is meant estimating the amount of milk the infant consumes in varying times during the feed. For instance, it may be found that if an infant obtains a total amount of 3 oz. from one breast in 7 minutes, 2 oz. of this quantity may be obtained in the first 3 minutes, and the remainder at a decreasing rate during the next 4 minutes. It is quite surprising how frequently it happens that an infant obtains nearly the total amount of milk in the first few minutes, and afterwards swallows more air than milk. This matter will be referred to later in the sections which deal with the complications of feeding.

The total amount of breast milk that an infant should take in the 24 hours may be estimated either on the basis of its age or its weight. If the infant is perfectly normal it makes no difference on which basis the amount is calculated, in either case the amount will be the same. If, on the other hand, the infant is abnormal in any respect, if it is debilitated, under-weight, or

[1] Appropriate scales can be bought or hired from Messrs. C. Pollard, 130, York Road, King's Cross, London, N.1.

over-weight, special allowances and corrections must be made; but in the feeding of perfectly normal infants the simplest method of estimating their requirements is to give 2½ oz. of milk for every pound of body-weight, or what is the same thing 50 Calories per pound of body-weight. If, for instance, a baby weighs 8 lb. it should receive 20 oz. of milk in the 24 hours, or food of the value of 400 Calories, and if it is fed three-hourly with a total of six feeds the amount at each feed should be 3½ oz. This rule, however, does not apply during the colostrum period, or indeed during the first few days after the establishment of lactation. There should be a slow and gradual progression in the total amount received until it reaches the estimated requirements.

Complementary and Supplementary Feeding

A complementary feed is one which is given immediately after a breast feed to make up the quantity to the required amount. A supplementary feed is one which is given in place of a breast feed. When for any reason the supply of breast milk does not reach the estimated requirements, the deficit should be made good as already mentioned by means of complementary feeds of expressed milk, or some artificial substitute. It is far more satisfactory to make each feed up to the required amount than it is to allow the infant to go short at any one particular feed, and make up the deficiency by giving it more at the next, or by giving it a full supplementary feed of artificial substitute without any breast milk at all. If the deficit cannot be made good by expressed breast milk the choice of supplementary food should lie between some carefully modified cow's milk preparation, and what is usually found to be much more convenient, some well-humanized dried milk, such as Ambrosia, Cow and Gate, Trufood, or Ostermilk. The advantages offered by a dried milk are very obvious. Firstly, it is economical as there need be no waste, and the food is ready for use in any quantity at any moment.

The Composition of Breast Milk

The average composition of breast milk is as follows:

Proteins	1·5 per cent
Fats	3·5 ,,
Milk sugar	6·5 ,,
Mineral matter	0·25 ,,

Individual samples of milk may differ quite considerably from the above standard, if such samples are taken at different times or at different periods during a feeding. It may indeed differ

from day to day or from week to week, but as a general rule the composition remains practically constant during the whole period of lactation. The milk does not become stronger or weaker as lactation proceeds, as long as the mother remains in health, and has an ordinary dietary.

Chemical analyses of breast milk are, as a rule, of very little value when they are made in the hope of discovering the reason why a baby does not thrive on the breast. When breast milk disagrees it is almost invariably due to the fact that it contains some toxic matter or bacterial contamination which an ordinary chemical examination does not reveal; or if the infant without exhibiting any definite symptoms simply fails to gain in weight, the common cause is insufficiency of quantity. If, however, any gross defect can be discovered in the milk, as for instance a deficiency of fat, it is far easier to correct the defect by supplementary feeding with some good fat emulsion, such as Vitoleum Cream, than to attempt to alter the secretion by variations in the mother's dietary. Similarly, it is difficult to increase or decrease the total quantity of milk secreted. You certainly cannot increase the amount by increasing the mother's dietary, if she is already taking physiological quantities, or by giving her more to drink. The chief determining factors in the quantity are the degree of stimulus which the infant imparts by sucking and the inherent secreting capacity of the gland itself. Something can be done by skilful massage of the breasts or by manual expression by the mother herself. The application of alternate hot and cold compresses are occasionally employed as a means of stimulating the breasts to increased activity, but this method like that of electrical stimulation cannot be depended on as a practical solution of the difficulty, and in this connection it should be very definitely understood that there is no such thing as a genuine galactagogue. Many preparations are on the market which claim to act in this capacity, and to increase the secretion of milk. If they have any such action it is only by reason of the psychological influences they exercise on the mother's mind.

Technique of Breast Feeding

Position in which to hold the Baby. The comfort, both of the mother and of the infant during a feeding should be carefully studied, and this is more dependent on the position in which the child is held than on any other factor in the technique of feeding. It is not infrequently discovered by means of the test feed that the infant obtains more milk from one breast than it does from the other. This is usually due to the different position in

which the baby is held on the two sides, and suggests the importance of this detail in the management. Sometimes the nose of the infant is so buried in the breast of the mother that it cannot breathe, or sometimes the nipple is twisted at an angle which obstructs the normal flow of milk. Whether the infant is fed while the mother is in bed, or when sitting in a chair, he should be comfortably supported along the whole length of his body by the arm of the mother, which in turn should itself be supported on a pillow or cushions of adequate height to relieve her of all physical exertion.

For the first two or three days after birth it is usual for the mother to be in the recumbent position, and to lie on one side. If this is so, the breast should be allowed to hang over the infant, so that the nipple drops naturally into its mouth. It is not, however, necessary to continue this awkward arrangement beyond the third day, for there is no reason why the mother should not after that time be allowed to sit up in bed and feed the baby in the same way that she will adopt later when she sits in a chair. When this time arrives care should be taken to see that the chair is a low one and that the arm is well supported by an adequate supply of cushions or pillows.

DIFFICULTIES AND COMPLICATIONS OF BREAST FEEDING

Difficulties arising in the Mother

1. Chronic Illnesses.

The following illnesses in the mother are usually considered to contra-indicate breast feeding: diabetes, eclampsia, epilepsy, heart disease, nephritis, anæmia, and tuberculosis. With this list I am in agreement, except in so far that in my opinion anæmia in the mother should be treated appropriately, and unless of the pernicious type, will usually allow satisfactory nursing.

Again, in connection with tuberculosis, this in my opinion requires very careful consideration. It is common experience to find that the health of tuberculous women improves enormously under the stimulus which pregnancy affords to general metabolism, but it is equally common to find that after the confinement there is a great exacerbation of the specific symptoms, with loss of weight and general impairment of nutrition. This retrogression is in my opinion largely due to the withdrawal of the natural stimulus of the pregnant state. In a minor degree lactation is

itself a stimulus to metabolism, but tuberculous mothers practically never get the benefit of this owing to the fact that they are not allowed to nurse their babies, not only because this practice is supposed to be exhausting to the mother, but also for fear of the infant becoming infected. Personally, I have very grave doubts whether either of these arguments is sound. It is consistently believed that breast feeding is debilitating to the mother, but the grounds on which this supposition is based seem to me to be of the flimsiest character. In a very large number of cases in which I have had to decide whether a tuberculous mother should nurse her baby or not, and in which I have advised in favour of the former choice, I have never had reason to regret the advice I have given, because as long as the nursing continued the mother's health was almost invariably well maintained.

From the point of view of infection of the infant, there is this to be said. It is almost impossible for any infant of a tuberculous mother—that is to say one suffering from open tuberculosis, to escape direct or indirect inoculation with the tubercle bacillus, whether it is breast fed or not. Breast feeding does not appear to introduce any particular additional dangers, but it has certain definite advantages, since no form of feeding is better for the infant than breast feeding, and the latter gives the infant an additional chance of acquiring increased resistance to this variety of infection, owing to a superior condition of general nutrition. Moreover, it is exceedingly probable that the breast milk of a tuberculous mother contains a certain representation of immunizing bodies, which will help to protect the infant against this specific infection. Whether or not an infant succumbs to infection from a tuberculous mother depends partly on its resisting powers, and partly on the massiveness of the infection. I have found from practical experience that the resistance of babies born of tuberculous mothers may be artificially increased by preventive inoculation with tuberculin, as described on page 157, and in my opinion this prophylactic measure should always be resorted to in every case in which there is any danger of infection.

In addition to the above list of chronic diseases, which may be regarded as a contra-indication for breast feeding, there are a number of acute conditions, such as influenza for instance, in the mother which may interfere temporarily with the continuance of breast feeding. Under such conditions there is usually no need to wean the infant permanently, for the latter may be fed artificially till the mother is well enough to nurse, and her breasts may be kept in active secretion by manual expression of the milk.

2. Deficient Supply of Milk.

A deficient supply of milk, especially after the sixth month of life, is a frequent cause of failure on the part of breast-fed infants to gain in weight. There should, however, never be any doubt as to whether or not this is the cause of defective nutrition, since a " test feed " will at once settle the question. Even without a " test feed " a defective supply may be suspected by the following evidences in the mother and child.

Evidences in the Mother.

(1) Difficulty in expressing milk, no overflow, and no difference in the size of the breasts before and after feeds.
(2) No feeling of " draft " during feeding. The draft being a sensation as if the breast were filling with milk, but really due to vascular engorgement.

Evidences in the Infant.

(1) Failure to gain in weight.
(2) Dissatisfied after feeding.
(3) Long duration of feed.
(4) No vomiting, unless due to air-swallowing.
(5) Restricted secretion of urine.
(6) Scanty or starvation stools.
(7) Small liver : small fontanelle.

The causes of a defective supply may be some congenital or acquired abnormality in the breasts, such as absence of, or depressed nipples ; some inherent incapacity in the secretory functions (rare) ; nervous conditions or anxieties in the mother (common) ; incomplete emptying of the breasts, and weak sucking on the part of the infant.

Treatment. To increase the supply of milk the first essential is to discover and correct the underlying cause. Favourable results have been reported from the direct application of ultra-violet radiation of the mother, as also from the oral administration of irradiated yeast, or even of ordinary yeast preparations, such as Yestamin. I have myself given in cases of refractory lactation, two or three tablets of the latter preparation three times a day, with apparently good results. The hormone folliculin, or œstrin, prepared from animal ovarian follicles has also been tried, but with doubtful success ; so also have preparations of the pituitary gland (anterior lobe). Hypodermic injections of milk are recommended by Dr. L. G. Houston in his book " The Breast-Fed Baby in General Practice," but for all practical purposes, if the following measures fail to produce the desired increase in the secretion, I do not advise resort to any of the more fanciful methods.

(*i*) *Diet.* The diet should be ample, but not excessive. It should contain a good representation of all the vitamins and mineral elements. Stout or other alcoholic beverages are not specially indicated, unless the mother has been in the habit of taking them, in which case their omission is felt, and is a mistake. Large quantities of milk or other fluids are not advised.

(*ii*) *Mechanical Stimulation of the Breasts.* Manual expression by the nurse or mother, combined with the use of the breast pump, if skilfully applied, is by far the most reliable means of increasing the supply. Milk expressed by these means should be given by bottle or spoon to complement deficiencies in the feeds obtained by the infant's own efforts.

(*iii*) *Drugs.* There is no such thing as a reliable galactagogue, but yeast and other preparations containing vitamin B, may be given in addition to the ordinary food.

(*iv*) *The Psychological Factor is of Importance.* The mother should be encouraged in every way, and made to believe in her capacity to nurse satisfactorily.

(*v*) *Emptying of the Breasts.* The breasts should be completely emptied at each feed, if not by the infant, then by manual expression.

(*vi*) *Hygiene.* All the ordinary hygienic details of a normal healthy life, such as moderate exercise and plenty of fresh air, should be provided.

3. Excessive Supply of Milk.

Many an infant is overfed to its own destruction by an excessive secretion of milk. The comforting assurance that Nature co-ordinates the supply to the requirements is a very fallacious guide for conducting breast feeding, as also is reliance on the safeguards which the infant possesses in its own protective reflexes of appetite, overflow and vomiting. The "test feed" will at once show whether an infant is overfed or not, but short of this invaluable proof the following evidences in the mother and child will help to clear up the doubt.

Evidences in the Mother.

1. Overflow day or night: ease of manual expression: decreased size of breasts after feed.
2. The presence of the "draft" during feeds (see page 22).

Evidences in the Infant.

1. Excessive increase in weight.
2. Short duration of feed.
3. Copious overflow or vomiting after feeds.
4. Excessive secretion of urine.

5. Frequent or copious stools.
6. Large liver and large fontanelle.

Treatment. The usual method of attempting to restrict the amount of milk taken at a feed by reducing the time of nursing is practically useless, for as a rule the infant obtains the whole amount in the first 3 or 4 minutes, and under such conditions it is almost impossible to reduce the time of a feed to the required extent. It is also worse than useless to give the infant a drink of water before the breast feed—this only adds to the distension and increases the likelihood of vomiting.

In order to maintain lactation it is essential that the breasts, or at least one breast, should be completely emptied at each feed. If the evidence of the test feed proves that even one breast affords an excessive amount of milk the solution of the difficulty is to express or draw off by means of a breast pump an adequate amount of " fore milk " before each feeding, and leave a sufficient quantity of " strippings " to satisfy the estimated requirements of the infant. Another, but a less satisfactory method, is to attempt to control the rate of flow by manual pressure on the ducts of the mammary glands external to the æreola, and then at the end of the feeding to empty the breasts of residual milk by " expression."

Collecting Glasses or " *Shells.*" One of the troubles connected with an excessive secretion of milk is that the mother's clothing may become soaked and soiled by the overflow. This inconvenience can be obviated by the use of collecting glasses, which can be easily applied to one or both breasts, and held in position by a crepe bandage. Milk thus collected need not be wasted, it is often of great value in maternity institutions in which it can be used for the feeding of babies who get an insufficient supply from their own mothers, or have special needs.



FIG. 1.—Collecting Glass.
(*Maw Son & Sons*).

4. Defects in the Nipples.

RETRACTED NIPPLES. The existence of retracted nipples is often given as a reason for abandoning breast feeding. It is not however a valid excuse, since if the nipples cannot be sufficiently drawn out by manipulation with finger and thumb, by a breast pump or cupping-glass to enable the infant to obtain an adequate grip, " expression " of the milk by hand milking (which with very little trouble can be practised by the mother herself), is capable of being continued almost indefinitely with complete success.

The existence of retracted nipples should be discovered long before the birth of the infant, and treated by systematic " drawing

out " at least 6 weeks before the time of the expected confinement. The technique is simple—the nipple should be held firmly between the finger and thumb, and drawn out five or six times as far as possible, and this operation can be carried out by the expectant mother herself and continued daily for 6 weeks or longer before the birth of the child.

5. Cracked or Sore Nipples.

Both these conditions often make breast feeding painful or unendurable. Since however they are preventable the abandonment of breast feeding on such grounds should be regarded as a definite failure of ante-natal or post-natal management.

Prevention. Nipples that are unprepared for the ordeal and rough handling they usually experience when the infant is put to the breast five or six times a day and for several minutes, are very liable to become sore, or " chapped " by friction and maceration in the infant's mouth. To prevent such a catastrophe the epithelium of the nipples should be prepared and hardened before the birth of the infant, by massage with some emollient preparation such as vinolia or haseline cream, and further they should have an occasional application, say once a week for some 2 months before the expected date of the birth, of a solution of tannic acid in methylated spirit (see page 702). I do not commend the practice sometimes adopted of scrubbing the nipple with a nail-brush. A good deal can be done to pursue prophylactic treatment after the birth of the child by not allowing the infant to suckle too long for the first week after birth, and by taking every precaution to see that the surface of the nipple is kept perfectly dry. With the slightest indication of soreness there should be an immediate application of Friar's Balsam, or acriflavine (1 in 1500), or if this does not effect a cure the nipple should be painted as above described with tannic acid solution. It should then be allowed to dry by exposure to the air.

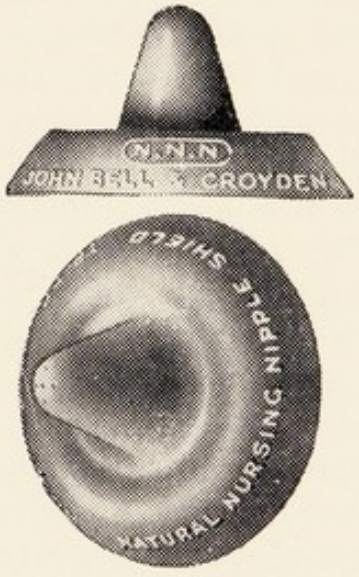


FIG. 2.—Nipple Shield.
(*Bell & Croyden*).

If once an actual fissure has developed the treatment must be more energetic, and until a cure is effected the infant must not be allowed to apply his mouth directly to the nipple. Under such circumstances the latter must be protected by the employment of a suitable breast shield such as that illustrated. If however in spite of any or all of these procedures there is still an opening up

of the crack, or bleeding during the emptying of the breast, the milk must be temporarily drawn off by hand-expression and given in a bottle or by spoon. In the case of a very refractory fissure the raw surface should be touched with caustic and the granulating surface painted occasionally with a tannic acid solution. With patience and resourcefulness most cases can be ultimately cured sufficiently quickly to enable the early resumption of direct feeding. Since cracked nipples are a prolific source of mammary abscess, every possible precaution should be taken to prevent their development, or should cracks actually occur, every available step should be taken to effect an immediate cure.

6. Mammary Abscesses.

Both mastitis and mammary abscesses constitute such serious complications of breast feeding that a few words on these matters are called for. It is generally believed that the pre-existence during pregnancy of any septic focus in the mother, such as that of carious teeth, follicular tonsillitis, or coli infections of the urinary tract, predisposes to mammary infections ; for this reason such matters should be carefully attended to. But my personal experience points rather to cracked nipples, and engorgement of the ducts or blood-vessels of the mammary gland as the more usual causes of these troubles. Hence, prophylactic measures should include proper care of the nipples, both before and after birth as described in the preceding sections, and also the prevention of any knotting of the glandular tissue, or damming back of the secreted milk in the lactiferous ducts. Massage skilfully applied from the periphery towards the nipple so as to empty the ducts and blood-vessels is very helpful in preventing knotting or engorgement of the breasts. If these simple measures fail to stay the inflammatory processes, and should an actual abscess form or threaten, the breasts should be fomented, until hardness has disappeared or the abscess has formed ; in the latter case the abscess should be immediately opened by a radiating incision.

The question always arises in such cases as to whether the infant should be weaned temporarily or permanently, or whether it should be allowed to extract what milk it can from the unaffected side. From long experience of difficulties arising under these conditions I am prepared to say quite definitely that if an abscess has already formed or is in process of forming in one breast, the milk from both the sound breast and from the affected one, is teeming with living organisms, and that these are real sources of danger to the infant, even though the latter may ultimately acquire some degree of immunity from swallowing the living organisms, or from toxins or anti-bodies contained in the milk.

The disadvantages of weaning the child are however so great that I would recommend the following compromise. The milk from the sound breast should be drawn off by means of hand-expression or breast pump, sterilized by boiling and then given to the infant by bottle or by spoon. Whether the milk from the affected side should be dealt with in the same way depends on the amount of pus present in the milk, and this can only be settled by laboratory examination. If there is any considerable amount of pus the milk should be thrown away as unsuitable and not given to the infant even though it be sterilized.

7. Onset of Menstruation in the Mother.

Is this event a legitimate reason for weaning the infant? In my opinion it is not, but all the same I have known so many cases in which the return of the catamenia has been followed by definite disturbances of one kind or another in the infant, that I am convinced in such cases that the two events stand to one another in the relationship of "cause and effect." My advice therefore is to watch very carefully and observe whether there is any obvious disturbance to health in the infant, and if there is, to wean it temporarily on to a suitable substitute, and meanwhile keep up the functional activity of the breasts by manual expression of the milk, but to return to breast feeding as soon as the period is over.

Difficulties in Connection with the Infant

1. Difficulties in Connection with Sucking.

Nervousness, Nasal Obstruction, Sore Mouth, etc. Infants often refuse to take the breast at first owing to some defect in their nervous organization, for instance, mongols and mental defectives not infrequently give trouble in this respect, but this is no argument for relegating such infants to the bottle. A little resourcefulness will usually overcome the difficulty. Infants may be encouraged to suck by smearing the nipples with glycerine, honey, condensed milk, etc., or by expressing the milk or colostrum by manipulation with the fingers. Anything which interferes with natural nose breathing tends to interrupt breast feeding, because the infant must occasionally let go of the nipple and open his mouth in order to gain his breath, and the same applies in cases of atelectasis or congenital heart disease, owing to the dyspnœa to which these conditions give rise. Under such conditions milk may have to be expressed till the infant has learned to accommodate itself to circumstances.

If infants experience at any time pain or discomfort in the act of sucking, as for instance when they have a sore tongue or mouth, they are very liable to become for a time "breast-shy," and refuse

to apply their lips to the nipple. This difficulty can usually be overcome by giving the infant an opportunity to forget his experiences by temporary bottle or spoon feeding with expressed milk.

2. Hare-lip and Cleft Palate.

Neither of these conditions, nor indeed the two combined, render it impossible for an infant to be breast fed, though certainly they make it more difficult, but with a little patience and resourcefulness the trouble can usually be overcome.

It must be remembered that the infant does not extract milk from the breast by forming a vacuum in the mouth, but he does so by a modified process of milking, that is to say, by squeezing the breast between the tongue and the roof of the mouth, and thus emptying the lacteal ducts. To this procedure neither the gap in the upper lip nor the hiatus in the roof of the mouth afford any serious impediment. It is however important that the infant should get a good hold of the areola of the breast, and not merely take the nipple into his mouth, so that the breaches in the walls of the buccal cavity may be well filled up.

Cases of hare-lip should be surgically treated as soon as the infant's condition allows. The longer the operation is postponed the more difficult it becomes, and from an æsthetic point of view, the less successful the results. After the operation, until the flaps are firmly united and the stitches removed the infant should be fed by spoon with expressed milk. Operations for cleft palate should be deferred until the eye teeth have been cut, and the infant is about two years old.

3. Diarrhœa or Frequent Motions.

It sometimes happens that with breast feeding an action of the bowels takes place each time the infant is put to the breast. This usually represents the establishment of a conditioned reflex which is dependent on the stimulus afforded by sucking, swallowing, and other associated motor functions. It must be treated by re-educational methods. The administration of opium, chloral, or bromide will help to quieten down all the motor functions of the alimentary tract, and thus mitigate their stimulating effect on the neuro-muscular mechanism of defæcation, while full doses of calcium will help to provide insoluble soaps as a basis for more solid stools. The following prescription will be found useful in such cases.

For a baby of three months or under:

Camphorated Tincture of Opium .	1 minim (0·06 c.c.)
Bromide of Ammonium . . .	3 grains (0·2 gm.)
Dill water	20 minims (1·2 c.c.)

Chloroform water to make 1 fluid drachm (3·5 c.c.)

One drachm (3·5 c.c.) to be taken before each feed.

The calcium may be given independently in the form of prepared chalk, and in the quantity of 20 grains three times a day in milk. It is not, as a rule, necessary to continue this treatment for more than a few days. Another way of treating this condition is to bring about reactionary constipation by over-stimulation of the neuro-muscular mechanism of defæcation, by giving an occasional glycerine enema, or by inserting into the rectum a glycerine suppository. If the latter plan is selected, care must be taken to ensure that the gelatine capsule melts in the rectum and liberates the glycerine.

4. Constipation.

Constipation in breast-fed infants is more difficult to treat than when it occurs in those artificially fed, since the quality of the milk is not under the same control. In the first place the possibility of underfeeding must be excluded by means of the "Test" feed (page 17), and secondly, the rectum must be examined to ascertain whether it contains scybala or fæcal matter, since the presence of either would indicate that the rectum had lost its normal sensitiveness, and requires special treatment to restore it. The following prescription will be found of use:

Liquid Extract of Thyroid . . .	1 minim (0·06 c.c.)
Tincture of Nux Vomica . . .	1 minim (0·06 c.c.)
Cascara Evacuant	2 minims (0·12 c.c.)

Petroleum Emulsion (30%) to make 1 fluid drachm (3·5 c.c.)

Dosage: One drachm before each feed.

If on examination the rectum is found to be empty, the thyroid and nux vomica may be omitted from the above prescription, and the dose of cascara adjusted to the requirements, as the condition yields or proves refractory to treatment. Spasm of the anal sphincter is another cause of constipation in young children; the condition should be treated by forcible dilatation with the finger, or by the appropriate treatment of a fissure if such exists.

5. Vomiting.

Vomiting in the case of breast-fed infants must be treated on the general lines described on page 176, but it is particularly important to ascertain whether the vomiting is connected with the particular way in which the infant obtains its milk from the breast, for instance, he may take it too quickly or may swallow air in the process. The time after a feed at which the vomiting occurs should be noted, that is to say, whether it occurs immediately after a feed, or some time afterwards. Habits of possetting, regurgitation, and rumination, are very easily acquired and must be treated on the special lines indicated in such cases (see page 184).

WEANING

The term "weaning" is loosely applied to cover the three following changes in the method of feeding infants:

1. Change from breast feeding to bottle feeding.
2. Change from breast feeding to a mixed dietary.
3. Change from bottle feeding to a mixed dietary.

Only the first two of these will be considered here, the third will be described in Chapter III.

Weaning from Breast to Bottle.

Infants are often taken off the breast and condemned to bottle feeding on most inadequate grounds. Sometimes because they do not appear to be satisfied and are incorrectly believed to be underfed. Sometimes because they develop such symptoms as those of vomiting or diarrhœa, which are entirely unconnected with the method of feeding. Sometimes because they do not gain sufficient weight to satisfy anxious parents or nurses, and sometimes for other unjustifiable reasons.

Before weaning an infant for any of the above causes a careful inquiry should be conducted to exclude the possibility that the fault lies not with the milk or the method of feeding, but with the infant itself. "Test" feeds should be conducted to settle the question of quantity, and the history of the case should be reviewed to discover whether there are any valid grounds for believing that the quality of the milk can be responsible for the symptoms. I have known many cases in which infants have for a time made good progress and then have suddenly developed symptoms and lost weight, and for this reason have been weaned from the breast. Under the conditions it was extremely improbable that the milk itself was at fault. If it had been, the infant would not have made good progress at first. In the majority of cases of sudden failure of this kind the cause is to be sought in some infective condition arising in the child, very likely of a catarrhal or influenzal type. The identity of it may possibly be discovered by an investigation into the health of those who have been in contact with the child. Under such conditions the worst fate that can befall the child is to wean it and incur the additional risks of bottle feeding.

Neither deficiencies with respect to quantity of the milk supplied, nor indispositions in the infant due to causes other than dietetic, justify weaning from the breast. In the first case complementary feeding may make good the shortage, and in the second breast feeding probably gives the infant the best chance of recovery.

If however after a very careful review of all the attendant circumstances it is decided that there is no alternative to taking the infant off the breast, the change to artificial feeding should be made as gradually as possible, and by easy transitions. Infants are sometimes weaned suddenly from the breast and given what are considered to be appropriate quantities of suitable artificial food, with the most disastrous results, merely for the reason that the essential precaution had not been taken of ascertaining in advance the actual amounts of breast milk which the infant had heretofore been in the habit of taking. It is for instance hardly reasonable to expect that an underfed infant taking let us say 1 oz. of breast milk at a feeding, will be likely to do well if after weaning it is given 3 to 4 oz. of some artificial and far more indigestible substitute.

The amount of milk which infants are allowed to take after weaning should be based at first on the amount of breast milk they have previously taken, and the quantity should only be gradually increased up to the correct amount as estimated on a basis of age and weight, if the infant is found capable of taking the larger quantity.

If infants have to be suddenly weaned from the breast it is unwise to give them at first ordinary cow's milk of breast standard. The change from so highly digestible a food as breast milk to so highly indigestible a food as cow's milk often upsets the functions of digestion. It is better under such conditions to give milk mixtures which have been previously peptonized, or condensed milk, lactic acid milk, or citrated milk, which are better tolerated.

Complementary feeding or supplementary feeding, employed for a time in conjunction with " test " feeding, is nearly always possible, and gives better results than precipitate or panicky weaning on to exclusive artificial feeding.

Weaning from Breast to a Mixed Dietary.

However good may be the quality of breast milk, and however ample the supply, exclusive breast feeding after the sixth month does not appeal to me as fulfilling the essential conditions of physiological feeding. At this period of life the infant requires some expansion of his dietary to provide for the development of the digestive functions. For instance, he should begin to learn how to digest starch, and with the eruption of the teeth opportunity should be given to exercise the functions of mastication, so as to ensure adequate development of the jaws. But at this age and for some time to come milk itself must form the greater proportion of the total dietary, and if milk is to be given it is clearly desirable

that it had better be breast milk with all its inherent advantages than an inferior substitute such as modified cow's milk.

The successive stages in the gradual expansion of the dietary should be as follows :

At the sixth month the number of feeds would probably be five in the 24 hours, namely, at 6 a.m., 10 a.m., 2 p.m., 6 p.m. and 10 p.m.

If this be so, at the 2 p.m. feed the infant may have in addition to the correspondingly reduced breast feed, 2 oz. of Benger's Food, prepared according to the formula given on page 709, and at successive intervals of one week, this may be varied, firstly by a small quantity of thin semolina pudding, secondly by custard pudding, thirdly by potato and gravy, fourthly by potato, green vegetables and gravy, and fifthly by a two-course meal consisting first of vegetables and gravy, and secondly of milk pudding and stewed fruit.

After the seventh month, and concurrently with the above changes, the ten-o'clock morning feed may be complemented with a rusk, which the infant may be allowed to nibble at for a few minutes before being put to the breast. This will give it an opportunity of exercising and developing the functions of mastication. Later, crusts or toast may be substituted for the rusk, and these may be smeared with a variety of foods or condiments, such as butter, Marmite, egg, honey, etc., which will accustom the child to variations in taste and flavour. From this stage onwards the breast-fed infant may be gradually introduced on to a three-meal-a-day régime, with only small breast feeds first thing in the morning and last thing at night.

CHAPTER III

ARTIFICIAL FEEDING OF INFANTS

The practical details of artificial feeding would be greatly simplified if all substitute feeds were made up to breast-milk standard as regards balance, Calorie value, and digestibility. The composition of breast milk is as follows :

> Protein 1·5 per cent ; Fat 3·5 per cent ; Carbohydrate 6·5 per cent ; and the food value is 20 Calories per oz.

As regards digestibility, this is admittedly a difficult matter to adjust. There are many devices for rendering cow's milk preparations more digestible, but it must be remembered that they can be made too digestible by some of the methods of pre-digestion in common use, and thus fail in the purpose of developing the natural digestive functions of the infant up to the required standard of efficiency. In the following sections these several methods will be described, and the reasons will be supplied why under particular circumstances one method may be indicated in preference to others.

It must be remembered that a great many other elements in addition to the three primary fuel foods mentioned above are essential for nutrition. For instance, there are certainly five different vitamins, and at least a dozen mineral elements, each of which plays some part in the many different metabolic processes on which growth and maintenance depend. The proportional representation of each one of these several accessory factors may be assumed to be optimal in breast milk, and it should be the aim of those compounding artificial substitutes to maintain the same ratio.

This may sound a counsel of perfection, for some of these accessory constituents, although extremely important, are present in such minute quantities in breast milk that it would be manifestly difficult to provide them in exactly the same quantity in any artificial substitute. It is for instance supremely important that every infant should be provided with the correct quantity of iron,

iodide, and vitamin B, whether breast fed, or bottle fed, but the amount of these certainly varies in different samples of breast milk, and not infrequently falls below the standard of safety. In substitute feeding the danger of shortage in respect of these and other accessory food factors is still greater, for the reason that the representation of most of them is even less in cow's milk than it is in breast milk, a shortage which becomes still more pronounced if in accordance with the generally accepted methods of modification, the cow's milk is diluted with water.

In attempting therefore to modify cow's milk to the standard of breast milk it is not enough to look to the quantitative representation of the protein, carbohydrate and fat constituents alone, but regard must also be paid to the percentage content of many other essential elements, although it may be a practical impossibility to supply them in the exact amounts required.

In the details which are given in the particular sections for the preparation of substitutes for breast milk this principle is acknowledged, no matter what be the basic food out of which the preparation is made, whether for instance this is represented by cow's milk, goat's milk, dried milk, condensed milk, or some proprietary food. In each case some attempt is made to ensure that every one of the required constituent elements is present in approximately the same amount as it is in a good sample of breast milk.

Before giving instructions for the preparation of the different foods, I should like to call attention to certain particulars which are common to all methods of feeding, and to all kinds of foods, details which are connected with the times of feeding (pages 11 and 16), quantity of each feed (page 17), shape of the bottle, pattern of the teat, other matters connected with the sterilization of the food (pages 12 and 39), and its digestibility. Most of these matters have already been referred to in previous sections, but a few words are necessary in connection with the bottle and nipple.

The Feeding Bottle.

As regards the shape of the bottle, it may be stated generally that this is of very little importance. An ordinary medicine bottle graduated in ounces and half-ounces answers all the requirements quite as well as the most expensive and elaborate boat-shaped feeder. Openings at each end of the bottle for facilitating cleaning, as also complicated valves for the admission of air, are most unnecessary refinements. The bottles we use at The Infants Hospital are ordinary round bottles in two sizes, calibrated on the outside with raised markings, and without any valves. They have a convenient-sized neck over which the free end of the rubber

nipple can be slipped.[1] These bottles can be easily cleaned with a rotating brush electrically driven, and rinsed out by means of a jet of hot water. The ease with which bottles can be cleaned is a matter of great importance in an institution where large numbers are used, but in private households such matters need not be considered, for the best and safest way of cleaning a bottle is to boil it. If this is done there can be no possible danger from bacteria, even though the bottle itself may not look particularly clean or have a particularly well-polished surface after it has been washed.

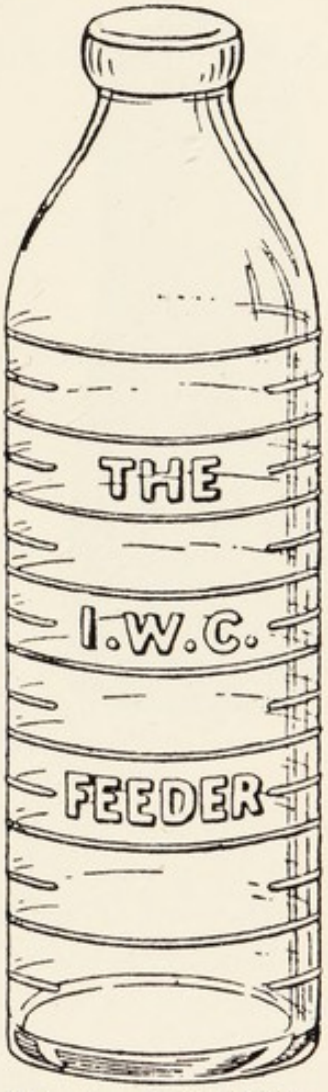


FIG. 3.—The I.W.C. Feeding Bottle.

The Nipple.

The shape of the nipple is important, because some varieties encourage the natural method of feeding, while others render it impossible. As has been previously stated (page 28), breast-fed infants obtain their milk from the breast by a process of expression or milking, and not by making a vacuum in the mouth. They should extract the milk from the bottle by the same means. I have designed two varieties of nipple, each of which fulfils the necessary requirements (Fig. 4).

Objections are sometimes urged by uninformed persons that large nipples of the kind here illustrated spoil the shape of the infant's mouth. If this were true, all breast-fed infants would possess ugly mouths, since for the successful expression of milk from the breast, it is necessary for the infant to take a large amount of the areola surrounding the nipple into the mouth, a larger mouthful in fact than is ever taken when an artificial teat is employed.

The size of the hole in the nipple is also a matter of some importance, as on it depends the time occupied in taking the feed. The hole should be sufficiently large to allow one drop of milk mixture to fall every second from the inverted bottle, that is to say, until a vacuum is formed in the bottle, when the rate of dripping will be slowed down. A hole of this size should enable

[1] Bottles fulfilling all these requirements can be obtained from the Association of Maternity and Child Welfare Centres, 117, Piccadilly, London, W.1, price 9*d*.

an infant to obtain the whole of its feed in from 10 to 15 minutes. If the hole is too small to allow this, it should be enlarged with a red-hot needle. If on the other hand the hole is too large, the nipple should be discarded and replaced by another, with a hole of the required size.



FIG. 4.—Nipples for Feeding Bottles. (*Bell & Croyden.*)

The opening in the teat may take the form of a slit cut by means of a razor-blade. Some authorities regard this as better than a "leech-bite" or other form of opening.

Mode of Preparing Substitutes for Breast Milk.

At the present time the problem of selecting the best substitute for breast milk in those cases in which artificial feeding is necessary is greatly complicated by the multiplicity of methods available. In the following pages a short account will be given of those methods which are in more general use. At the end of each section brief notes will be given with respect to the advantages and disadvantages under different conditions of these several methods.

A. COW'S MILK MODIFICATIONS

The percentage composition of cow's milk differs according to the breed of the cow, the season of the year, the period of lactation, the diet, the stage of milking, and frequency of milking, but in a mixed milk such as is obtained from the larger dairies, the composition is remarkably constant, and for all practical purposes may be assumed to be as follows:

Proteins 4 per cent. Fat 3·5 per cent. Sugar 4·5 per cent. Ash 0·5 per cent.

Milks from special herds, such as Jersey, Guernsey, or Holstein, or even from individual cows of the same breed, may vary so considerably as regards their fat content that no reliance can be placed on the accuracy of any method of modification, unless the milk itself has been subjected to chemical analysis and allowance made for its special quality. For these reasons it is probably

better to rely on a mixed milk in the making of any of the following modifications.

Graded Milks.

Under the Milk and Dairies Act of 1922, milk sold in the open market is graded in four categories, namely :

1. Certified Milk.
2. Grade A (T.T.).
3. Grade A.
4. Pasteurized.

The price of these milks varies with the quality—Certified being the most expensive, and Pasteurized the cheapest.

1. *Certified Milk.* The cows producing this must have passed a prescribed tuberculin test and veterinary examination. Every 6 months the whole herd must be submitted to this test and examination, and every cow added to the herd must be tested immediately before admission. The milk must be bottled on the farm, and must not at any time contain more than 30,000 organisms per cubic centimetre, or any coliform organisms in 0·1 c.c. : nor must it be submitted to heat in any form before sale.

2. *Grade A (Tuberculin Tested) Milk.* This is produced under the same conditions as Certified Milk, and is bottled before distribution. It must not at any time contain more than 200,000 organisms per cubic centimetre, or any coliform organisms in 0·01 c.c. It may be pasteurized.

3. *Grade A Milk.* This is similar to the Grade A (T.T.) milk, except that the tuberculin test is not required. To counteract this a veterinary examination of the herd is made every 3 months, instead of every 6 months. It may be pasteurized.

4. *Pasteurized Milk.* This is retained at a temperature of not less than 145° F. and not more than 150° F. for at least half an hour, and must be immediately cooled to a temperature of not more than 55° F.

These Orders for the grading of milk and certain others of 1923 and 1934 were revoked by the " Special Designations Order " of 1936, which prescribed the following specifications which are now in force.

" *Tuberculin Tested Milk.*" The conditions for this grade are substantially the same as those prescribed for " Grade A (Tuberculin Tested) Milk," under the 1922 Act—that is to say, it is milk from cows which have passed a veterinary examination and a tuberculin test. It may be bottled on the farm, or elsewhere.

It must not decolorize methylene blue within 4½ hours if the sample is taken at any time from the 1st of May to the 31st of October; or within 5½ hours if the sample is taken at any time from November 1st to April 30th. It must contain no coliform bacilli in 100th of a millilitre.

"*Certified Tuberculin Tested Milk.*" This is "Tuberculin Tested Milk" which has been bottled on the farm.

"*Accredited Milk.*" While conforming to all the other requirements for "Tuberculin Tested Milk," this grade need not be bottled on the farm, but can be bottled elsewhere.

"*Tuberculin Tested Milk* (*Pasteurized*)." This milk while conforming to the above requirements for "Tuberculin Tested Milk," must be pasteurized in conformity with certain special directions and not contain more than 30,000 bacteria per millilitre.

"*Pasteurized Milk.*" "Pasteurized Milk" without any further designation may be either of the grade of "Accredited Milk" or be ungraded. It must be pasteurized in accordance with certain definite specifications and must not contain more than 100,000 bacteria per millilitre.

In the nature of things, no raw milk, however carefully dairied or marketed, can be guaranteed to be entirely safe for infant consumption, or to be free from contamination with pathogenic bacteria. To render it safe, it must be sterilized by one or other of the recognized processes. For this reason there are to my mind no obvious advantages in paying a large price for a high-grade milk which requires sterilization just as much as any of the less expensive varieties. No claims are made that any of the high-grade milks are richer in cream, or better in any other way, than ordinary varieties, so that there is no justification for believing that they possess superior nutritive qualities.

For the general purpose of infant feeding and accurate milk modification, any ordinary mixed milk from a reputable dairy ought to be perfectly safe, but it must be sterilized before use, and the best way of doing this is to bring it to the temperature of boiling water in a double-chambered saucepan immediately before use, or at least in such a manner and at such a time that the dangers of subsequent contamination are reduced to a minimum. If the day's supply is made up at one operation and put into separate bottles which are sterilized, safely stoppered, and kept in a cool place, as in the process provided for by the Soxhlet apparatus (Fig. 5), all the necessary precautions to ensure safe milk will have been taken.

Cream. Creams are just as variable in their fat content as milk from different cows, but the average cream which is sold in London dairies and which is separated from the milk by the centrifugal process contains about 35 per cent of fat. If there is any doubt as to the fat percentage, inquiry should be made of the vendor, who will probably be able to supply the desired information.



FIG. 5.—Soxhlet Apparatus.
(*Author's modification. Bell & Croyden.*)

It must be remembered that from the point of view of bacterial contamination, and of the spread of infectious disease, raw creams are even more dangerous than raw milks, and therefore must be sterilized before use. From this point of view synthetic creams, such as Vitoleum Cream, have great advantages, for they require no further sterilization, but they should be added to each individual bottle immediately before use and not to the stock mixture.

Methods of Milk Modification

1. "Half and Half" Method.

This name has been given to that method of modification which depends on the dilution of cow's milk with an equal amount of water, and on the addition of cream and sugar to bring up the

percentage of the fat and carbohydrate constituents to the standard of breast milk. The details are as follows:

Milk	10 oz.
Cream	1 oz.
Sugar	1 oz.
Water to make 1 pint.	

Advantages. Simplicity of preparation.

Disadvantages. In this method no attempt is made to secure the correct balance between the soluble (whey) and insoluble (casein) proteins. The total proteins are slightly in excess of the breast-milk standard, and of a more indigestible variety. As compared with breast milk there is a deficiency of vitamins B_1, B_2, and C, of all the mineral elements except calcium phosphate, and also of all extractives, including lecithin and cholesterol.

Most of these defects can be compensated for by substituting 4 oz. of bone and vegetable broth (see page 708), for 4 oz. of water, in making up the mixture.

2. "Split-Protein" Method of Milk Modification.

This method aims at correcting the faulty balance which exists in cow's milk, or ordinary cow's milk modifications, between the casein and the whey proteins. The object is to adjust this balance and make it conform more or less accurately to that of breast milk.

In cow's milk the percentage of casein is about 3 per cent, while the percentage of the whey proteins—that is to say, the lactalbumen and lactoglobulin is less than 1 per cent. The corresponding balance in breast milk is 0·5 per cent of casein, and 1·0 per cent of whey albumen. In other words, there is six times as much casein in cow's milk as there is in breast milk, while the amount of whey proteins is about the same in each instance. This discrepancy between the two milks often causes pathological reactions of a somewhat serious character in infants, when cow's milk is substituted for breast milk.

In the first place the casein of cow's milk is very much more difficult to digest than the whey proteins, chiefly because it is thrown down as a heavy insoluble coagulum in the stomach, which must be liquefied before it can pass through the pylorus into the duodenum; and in the second place because it has a powerful buffering action on the hydrochloric acid which is secreted by the gastric mucosa. Hence, if the hydrogen ion concentration of the gastric juice is to reach the point at which pepsin is activated and casein digested, a very large quantity of acid must be secreted. This means that if the casein is digested at all the oxyntic functions of the stomach are over-developed with a great

probability that a permanent condition of hyperchlorhydria will result.

To obviate this misfortune various expedients have been tried from time to time to reduce the casein excess in cow's milk, without at the same time reducing below physiological requirements the percentage of the whey proteins or the total protein allowance. The great differences in the amido-acid make-up of the casein and whey protein molecules, and the consequent disparities in their biological values, explains why an excess of casein cannot make up for a deficiency of whey proteins, even when it is given in great excess. It is comparatively easy to remove all the casein from cow's milk by clotting with rennet and subsequent filtration, but it is a different matter altogether to remove part of the casein and leave the required 0·5 per cent in the filtrate.

This difficulty can however be overcome by removing all the casein and then to restore a sufficient quantity of it to bring its percentage up to 0·5 per cent, but in restoring the required quantity of casein it must be remembered that the coagulated casein which has been removed by filtration is no longer liquid, but a solid which will not mix properly with the whey filtrate when added to it, or indeed pass through an ordinary-sized hole in an artificial teat. This disadvantage can however be overcome by beating up the clot with a part of the filtered whey with a fork, or in some other suitable manner, before it is added to the rest of the mixture.

The details for making 1 pint of " Split-Protein " Mixture are as follows :

> Take 1½ pints of milk which has not been boiled : heat to a temperature of about 100° F. Add 2 teaspoonfuls of liquid rennet (Benger's), or 1 rennet tablet. Stir well and then allow to stand until a firm clot is formed. Then break up the coagulum with a fork and strain through muslin or a fine hair sieve.

The resulting filtrate, generally about 1 pint in volume, will then contain all the constituents of the original milk, except the casein, and a small proportion of fat, which will have become entangled in the meshes of the coagulum.

To restore to the whey filtrate the required quantity of casein, take one-sixth of the whole amount retained by the muslin or sieve, and pound it up well with a pestle and mortar, with a small quantity of the whey filtrate, until it assumes the character of a smooth homogeneous paste ; then continue to add sufficient

of the whey until the total reaches a volume of 1 pint. The mixture thus prepared will contain only 4 per cent of milk sugar, the same proportion as that of the whole milk. The difference between this and the normal percentage in breast milk—namely 7 per cent—must be met by adding to the total quantity of 1 pint, 3 per cent of milk sugar—*i.e.* 6 drachms.

This mixture will also be a little deficient in fat, since some of the total 3·5 per cent of fat contained in the original milk will have been retained in the casein coagulum. This deficit can be made good in various ways, the best of these is to give a small amount of fat independently of the feeds in the form of some good synthetic cream, such as Vitoleum, or cream may be added to the feeds as they are given. The total amount of fat required to make good such a deficit is generally about $\frac{1}{4}$ oz. in the 24 hours for an infant three months of age. This is about $\frac{1}{2}$ oz. of a 50 per cent emulsion. It is to be noted that the deficit cannot be made good by what would appear to be the simplest plan, namely, by adding a corresponding quantity of dairy cream to the mixture. This step would result in a further coagulation of casein in the mixture, and a general interference with its fluid consistency.

To sterilize this mixture it must be heated to a temperature of 145° F. for 40 minutes—that is to say, by the process of pasteurization. It must not be boiled, or heated above 145° F., or else the whey proteins will be coagulated and spoil the mixture.

Another method for preparing the "split-protein" modification of cow's milk is as follows:

To prepare 1 pint of mixture:

Take $1\frac{1}{2}$ pints of cow's milk, which must not be boiled, and raise to a temperature of about 100° F. To this add 2 teaspoonfuls of liquid rennet (Benger's), or 1 rennet tablet, and gradually stir in, and let the milk remain undisturbed until a firm coagulation has occurred. The clot should then be broken up with a fork and strained through muslin or a fine hair sieve. The filtrate should then be pasteurized—that is to say—heated to a temperature of 145° F. for 40 minutes, in order to destroy the rennet enzyme and prevent any further casein coagulation when the dairy cream is added. To 17 oz. of this sterilized whey filtrate should now be added 2 oz. of whole milk and 1 oz. of a 33 per cent dairy cream, both of which should be sterilized, with 6 drachms of ordinary milk sugar. The milk modification done in this way has practically the same balance as regards its main constituents as breast milk itself. It is however a little more indigestible.

Advantages. The balance, Calorie value, and digestibility of this modification is practically the same as that of breast milk. It is comparatively easy to make, and is not deficient in any important accessory factor, excepting the anti-scorbutic vitamin C.

Disadvantages. Definite disadvantages are that mixtures made in accordance with this method must be pasteurized at a comparatively low temperature, and not boiled; and they are rather expensive.

3. The " Top-Milk " Method.

If milk is allowed to stand in a bottle or other convenient receptacle for a sufficient length of time to enable the cream to rise, the upper portion, which is in fact nothing more than thin cream, or rich milk, is called " top-milk." The amount of fat which " top-milk " contains depends partly on the initial richness of the milk, partly on the time it is allowed to stand, partly on the temperature, and partly on the level at which the milk is drawn off. Specially graduated bottles are provided for preparing " top-milk " mixtures. These have a syphon arrangement whereby the milk may be drawn off at any required level. Assuming that the milk contains originally 3·5 per cent of fat (the general standard for dairy milk) and that a quart of such milk is allowed to stand in the humanizer for 5 hours, then if the lower three-quarters—namely—the 30 bottom oz. is syphoned off, and the upper 10 oz. left in the bottle, such " top-milk " will be found to contain on an average 7 per cent of fat. This enriched milk can now be used in the following manner for preparing a so-called " humanized " modification.

Take

" Top-milk "	10 oz.
Milk Sugar	1 oz.
Water to make 1 pint (20 oz.).	

Advantages. The method is simple and requires no added cream.

Disadvantages. Delay in preparation while cream is rising. Possible waste of separated milk which adds to expense. The 50 per cent attenuation with water reduces by half the quantity of all the constituents, unless this attenuation is compensated for by an addition such as bone and vegetable broth. Although this mixture of milk contains a sufficiency of total proteins, namely, 2 per cent, more than three-quarters of this total consists of casein, and less than one-quarter of whey proteins. In other words, it has a faulty protein balance.

4. Lactic Acid Milk, and Citric Acid Milk.

When lactic acid is added to milk the casein is precipitated, and the same result follows by the substitution of citric acid, lemon-juice, or hydrochloric acid, in corresponding proportions, or when lactic acid organisms are incubated in milk.

If the curds thus formed are thoroughly broken up by beating with a fork or whisk, the resulting product constitutes a very valuable food for ailing or delicate infants.

Details of Preparation. Take 1 pint of fresh milk, bring to boil, allow to cool, and then add drop by drop ½ drachm of lactic acid (B.P. 75 per cent strength, or ½ drachm of citric acid dissolved in 1 oz. of water, or 1 oz. of lemon-juice, stirring continuously the whole time, which operation should occupy not less than 10 minutes. The mixture should be kept in a refrigerator.

Advantages. Since the casein in the milk is precipitated by the mode of preparation and the clot broken up into fine flocculent particles, it is presented to the digestive juices of the stomach in a finely divided and very favourable condition for peptonization. Moreover, its acid reaction ensures the required hydrogen-ion concentration for peptonization to proceed. In other words—it neutralizes the high buffering properties of ordinary cow's milk. The chief use of this form of modification is in cases of hypochlorhydria, that is to say, in those cases in which the natural secretion of acid in the stomach is inadequate to produce the threshold of acidity for peptic digestion. It does not however encourage the natural development of the oxyntic functions of the stomach and should not be used indiscriminately for normal cases. It is also useful in cases in which vomiting occurs through the too rapid coagulation of ordinary milk in the stomach of the infant.

Disadvantages. The great excess of protein in lactic acid milk thus prepared makes it unsuitable for long-continued use, and tends to produce intestinal toxæmia and other results due to over-straining of the hepatic and kidney functions by quantities of protein which would not be tolerated in the case of ordinary milk.

Sour Milk.

This term should be reserved for lactic acid milk which has been prepared by the natural fermentation of the lactose contained in milk under the influence of any of the lactic acid organisms: that is to say—the Bacillus Bulgaricus, Bacillus Acidophilus, or the Streptococcus Lacticus. Ready prepared lactic acid (sour) milk can be procured from most dairies or from Messrs. L. A.

Hindley & Co., 29, Babbacombe Road, Bromley, Kent, under the name of Bulgolac.

Method of Home Preparation. One pint of milk should be warmed to blood temperature, and inoculated with 1 teaspoonful of an active pure culture of one of the above lactic acid organisms grown in milk, which may be procured from the Lister Institute, or by the addition of lacto-bacilline tablets (page 695). After inoculation, the milk should be left in an incubator, at a temperature of about 100° F. During this time quite a considerable quantity of lactic acid is produced by fermentation of lactose, as a rule sufficient to produce from 0·5 to 0·75 per cent of lactic acid. Before use the milk thus prepared should be thoroughly beaten up with a whisk to ensure the breaking up of the curd which has been thrown down in the process of fermentation.

Advantages. Sour milk thus prepared has all the advantages of ordinary "Lactic Acid Milk," but it also has an additional advantage in that the lactic acid organisms continue to develop in the intestinal tract and favourably influence the character of its bacterial flora by inhibiting the development of undesirable proteolytic organisms. The stools of infants who have subsisted on sour milk for any length of time are usually quite odourless, proving the restraining influence of the lactic acid organisms on the decomposition of the proteins of milk. I frequently employ sour milk in cases of foul-smelling motions and intestinal toxæmia.

Disadvantages. A great excess of protein is incidental to this method of preparation, and carries with it all the disadvantages of whole milk feeding, and unless additional sugar is added to compensate for the loss by fermentation, the low carbohydrate content of the food introduces troubles inherent to a faulty balance of this nature.

5. Citrated Milk.

By the term "Citration," is meant the addition of sodium citrate in varying quantities to milk. It is not limited to whole milk preparations, but applies equally to all milk dilutions. The effect of the addition of a sufficient amount of sodium citrate is to change the caseinate of calcium into caseinate of sodium, which under the influence of rennet or pepsin in gastric juice is converted into paracaseinate of sodium, which unlike the ordinary paracaseinate of calcium is soluble in water. The effect of the addition of sodium citrate is to increase the buffering action of the milk, in other words, to delay the attainment of the degree of acid concentration necessary for peptic digestion. Indeed there can be no doubt that paracaseinate of sodium, owing to its

soluble and liquid nature can pass too quickly through the pyloric aperture into the duodenum and thus escape peptic digestion, throwing the onus of digestion on the intestinal and pancreatic ferments, a task for which they are not always equal.

Mode of Preparation. The amount of sodium citrate which should be added to the milk may be anything from 1 to 5 grains to every ounce of whole milk. The usual amount is 2 grains. It may be added to the bottle immediately before feeding.

6. Whole Milk Method.

This method scarcely deserves inclusion among scientific methods of feeding normal healthy infants, but since it is still occasionally employed a few words on the subject may not be out of place.

Since the Calorie value of undiluted cow's milk is the same as that of human milk, both must be employed in the same quantities if the physiological conditions are to be fulfilled. The advantage of whole milk as compared with ordinary milk dilutions is that the infant obtains his full allowance of all the accessory factors without reduction, which cannot be the case with milk dilutions as far as mineral elements and vitamins are concerned, unless full precautions are taken to compensate for the dilutions by supplementary additions. This it must be admitted is a very substantial advantage, but it is more than off-set by the defect that with whole milk there is an enormous excess of casein. The disadvantages of this are explained on page 114.

If the milk is citrated the disadvantages connected with the indigestibility of the casein in the stomach are obviated, but this procedure does not remove other objections connected with intestinal digestion and secondary metabolisms in the tissue. The addition of 2½ per cent of sugar compensates for the deficiency of this element in whole milk, but it will increase the Calorie value of the food correspondingly, and necessitate a total reduction in the quantity if physiological limits are not to be transgressed. If the total quantity is decreased there will be a shortage of fat and accessory factors, which leaves one on the "horns of a dilemma."

Although whole cow's milk, that is to say ordinary dairy milk, is comparatively seldom employed nowadays in infant feeding, the practice of giving it in the form of dried milk, either whole-cream or half-cream is exceedingly common; whole milk in this form, however, is not exempt from any of the above disadvantages. The only form of dried milk which is free from these objections is that which has been humanized or modified in such a way as to secure physiological balance.

B. MODIFICATION AND USES OF MILK OF OTHER ANIMALS

Cow's milk is not the only mammalian milk suitable for infant feeding. As a rule it is the most easily obtained, and the cheapest, and therefore most generally used. There is however no variety of milk, including cow's milk, which corresponds at all closely as regards its chemical composition with human milk, as may be seen from the accompanying table.

TABLE II

COMPARATIVE COMPOSITION OF MILKS OF DIFFERENT ANIMALS. (TAKEN FROM VOLTZ.)

Milk.	Water.	Solids.	Fat.	Casein.	Total Proteins.	Sugar.	Ash.	Calorie value. Per oz.
Ass's . . .	90·12	9·88	1·37	0·79	1·85	6·19	0·47	14
Buffalo's . .	82·30	17·70	7·70	—	4·80	4·40	0·8	32
Cow's . . .	87·80	12·20	3·40	2·70	3·40	4·70	0·7	20
Goat's . . .	86·30	13·70	4·00	3·60	4·60	4·30	0·8	20
Human. . .	87·58	12·42	3·74	0·80	2·01	6·37	0·3	20
Mare's . . .	90·58	9·42	1·14	—	2·50	5·87	0·36	13

Ass's Milk.

My old teacher, the late Dr. W. B. Cheadle, was a great believer in the virtues of ass's milk, and did much in his day to popularize its use in London, where it could be obtained at certain dairies. Now it is difficult to procure, and has gone out of favour.

Advantages. The curd formed in the stomach is light and flocculent, very like that of human milk, and consequently easy to digest. Its low fat content is an advantage rather than otherwise in cases of dyspepsia. In using this milk it is wise to give supplementary supplies of all the vitamins, more especially A and D. It must of course always be sterilized before being given to infants. Its Caloric value is only two-thirds of that of cow's milk.

Disadvantages. Difficulty of obtaining supplies and too low fat content for long-continued use.

Buffalo's Milk.

In some parts of the world this milk is more easily procured than that of the cow. Its percentage composition does not appear to be constant from analyses which have been sent me from different parts of India, and the main variation is in respect to

its fat content, which is usually considerably higher than in cow's milk. Its casein content is variable but about the same as cow's milk.

Method of Modification. Buffalo's milk lends itself very satisfactorily to modification by the " split protein " method (page 40), since the loss of fat due to the removal of part of the casein curd, in the meshes of which some of the cream is entangled, helps to reduce the fat percentage to reasonable proportions.

Advantages. The same as those of cow's milk.

Disadvantages. Owing to the usually insanitary conditions under which buffalo's milk is dairied and marketed, it is particularly necessary to sterilize it after modification and before giving it to the infant. After sterilization it is perfectly safe.

Goat's Milk.

An effort is now being made by various Goat Societies to popularize the keeping of goats and the use of their milk for domestic and infant feeding purposes. In its economic aspects there is a great deal to be said in favour of this campaign, and with careful methods of stabling, grooming, and dairying, the argument often adduced against the general use of goat's milk on the grounds of its characteristic caprine taste and odour, loses much of its cogency.

Method of Modification. Like buffalo's milk, the simplest and easiest way of modifying goat's milk is by the " split protein " process (page 40). It should always be sterilized after modification.

Advantages. Goats are highly immune to tuberculosis and hence the relative freedom of their milk from Tubercle Bacilli has been used as a strong argument in favour of its employment in infant feeding. Since goat's milk, like all other milks, should certainly be sterilized before using for this purpose, this argument cannot be regarded as particularly convincing, and contrariwise, the charge that goat's milk may contain pathogenic bacilli (Bacillus Abortus, Brucella and Millitensis) because goats are particularly susceptible to undulant fever, and therefore is not safe to use, is not valid, for the bacilli are killed on boiling. The belief that goat's milk contains some element which causes anæmia in infants is probably incorrect.

Mare's Milk.

This can be used like ass's milk without modification, and has the same advantages and disadvantages. Its Caloric value is very low.

C. DRIED MILKS

Dried milks now have an immense vogue in this country, and deservedly so, owing to their many and obvious merits. They are easy to use, relatively cheap, clean, reliable, and always ready at hand. They are prepared by two quite different processes, *i.e.* by :

1. The Roller Process.
2. The Spray Process.

By the first method, milk which has been concentrated by condensation *in vacuo*, is spread on the revolving surface of a super-heated cylinder and dried in a few seconds. It is then scraped off and pulverized. Dried milk prepared in this way is definitely more digestible than ordinary cow's milk, but it has a distinctive flavour which militates against its use for domestic purposes, and after reconstruction with water the butter-fat floats on the surface of the fluid in the form of a greasy layer. This is of no importance from the point of view of dietetics or infant feeding, for in any case a demulsification of the fat must occur in the infant's stomach, but all the same it has an unpleasing appearance which sometimes detracts from the general use of this variety of dried milk.

Milk powders dried by the Spray process are also concentrated *in vacuo* before they are nebulized and dried in a current of heated air. The milk which is very rapidly dried by this means falls like a cloud of very fine snow to the bottom of the desiccating chamber. The resulting powder is very easily reconstituted with water in the form of a homogeneous fluid, much more like natural milk than a solution of roller dried milk. It is little, if at all, more digestible than dairy milk, but it has the advantage of tasting like ordinary milk if it is used immediately after drying, but on keeping it acquires a somewhat cheesy taste and odour.

Both varieties of milk powder when reconstituted with the same amount of water as is extracted during desiccation must have the same percentage composition as the wet milk from which they are prepared, and hence have not a suitable balance for infant feeding. Unfortunately, dried milks are often used without any modification at all, and hence the same good results have not been universally achieved as would have been the case if some attempt had been made to humanize them to breast standard. Unfortunately, it is no easier matter to modify a dried milk to breast standard than it is to modify " wet " milk. In both cases after adequate dilution the product must be fortified with sugar,

cream, and other accessory factors if it is to be brought up to breast standard. For these reasons I do not recommend the use of whole milk powders for infant feeding, especially since it is now possible to procure in a dried form properly humanized dried milks.

In the following Table are given examples of Full-Cream unmodified dried milks ; their percentage composition is given before and after reconstruction with water.

TABLE III

COMPOSITION OF FULL-CREAM DRIED MILKS

	Drying Process.	Water.	Salts.	Fat.	Protein.	Carbohydrate.	When diluted 1 drachm by weight, with 1 oz. water by volume.		
							Fat.	Protein.	Carbohydrate.
Cow and Gate (Full-cream) / Hæmolac (Cow and Gate)	Roller	2·5	6·0	27·3	26·6	37·6	3·4	3·3	4·7
Glaxo Full Cream (Ostermilk 2)	Roller	2·9	7·2	26·5	24·9	38·5	3·3	3·1	4·8
Ambrosia (Full-cream)	Roller	1·70	5·71	29·00	26·40	37·19	3·62	3·3	4·64
Trufood (Full-cream)	Spray	1·20	6·20	26·00	27·60	39·00	3·25	3·40	4·80

Method of Using. The directions usually given for the reconstitution of any of the above dried milks are to dilute them in the proportion of one measure (or scoop supplied by the manufacturers, which is reputed to contain 1 drachm by weight of the powder) to each fluid ounce of water. Teaspoons are of such variable size that they are useless for accurate measurement. The percentage composition of the reconstituted milks, as will be seen by an examination of the figures in the foregoing Table, differs very considerably from the breast-milk standard, and for that reason, without modification, they are in my opinion entirely unsuitable for the feeding of infants.

Half-Cream Dried Milks, and others in which the fat content has been reduced. In the preparation of these dried milks varying proportions of butter-fat are removed before drying. When reconstituted with water the balance in the majority of cases departs even further from breast standard than when whole milk or full-cream milk powders are employed, as will be seen from the following Table.

TABLE IV

COMPOSITION OF HALF-CREAM DRIED MILKS AND OF MILKS WITH LESS FAT THAN THAT OF BREAST MILK STANDARD

	Drying Process.	Water.	Salts.	Fat.	Protein.	Carbohydrate.	When reconstituted in the proportion of 1 drachm of powder to 1 oz. water by weight.		
							Fat.	Protein.	Carbohydrate.
Cow and Gate (Half-cream)	Roller	2·5	4·5	15·0	20·0	58·0	1·8	2·5	6·2
Ambrosia (Half-cream) . .	Roller	2·10	6·55	17·60	27·90	45·85	2·2	3·48	5·73
Trufood (Half-cream) . .	Spray	1·80	7·20	13·70	32·1	45·2	1·71	4·0	5·62
Ostermilk (1) (Half-cream) (Sunshine Glaxo) . .	Roller	2·0	5·0	20·00	17·0	56·0	2·5	2·1	7·0

Uses. For special purposes in which low fat and low sugar percentages are indicated, these milks may be of service, but I do not recommend them for prolonged use, owing to the fact that fat is an important vehicle for supplying fat-soluble vitamins and because it also serves as the only roughage available for infants (see page 7).

Like other dried milks the above varieties are usually diluted with water in the proportion of 1 measure (or 1 drachm by weight) to each ounce of water. The percentage of the resulting product is given in Table IV.

Humanized Dried Milks. These milks are the best varieties for general use in infant feeding. On the whole they are more accurately modified to breast standard by the manufacturers than could be expected from any method of home modification of either cow's milk, or dried milk (whole). None of them are absolutely correct as regards the proportion of soluble and insoluble proteins, nor indeed as regards vitamins and other accessory factors, but in these respects they are probably less faulty than most of the milk modifications which are prepared domestically from dairy milk. The argument has been urged against them that they are expensive, but as a matter of fact they cost little or no more than cow's milk properly modified to breast standard. It is true they are more expensive than many of the milk dilutions in common use which are not brought up to breast

standard by additional cream. Butter-fat is much the most expensive element in milk, but the existing proportions of fat in different milk mixtures is often not taken into account in calculating the relative costs. In the following Table is included a list of some of the best-known varieties of Humanized Dried Milks.

TABLE V

COMPOSITION OF HUMANIZED DRIED MILKS

	Drying Process.	Water.	Salts.	Fat.	Protein.	Carbohydrate.	When reconstituted in the proportion of 1 drachm of powder to 1 oz. water by weight.		
							Fat.	Protein.	Carbohydrate.
Cow and Gate (Humanized), *breast-milk standard* . .	Roller	2·0	3·2	26·5	13·6	54·7	3·3	1·7	6·9
Ostermilk (1) Sunshine									
Glaxo humanized . . .	Roller	2·0	5·0	20·0	17·0	56·0	2·5	2·1	7·0
Ambrosia (Humanized). .	Roller	2·0	4·0	20·0	16·40	57·60	2·5	2·05	7·2
Trufood (Humanized), *breast-milk standard* . .	Spray	1·00	5·50	29·30	11·95	52·25	3·66	1·4	6·50
Lactogen, *breast milk standard*	Roller	2·0	3·5	25·0	16·2	53·3	3·12	2·03	6·66

Method of Use. All these milk powders should be reconstituted in the proportion of 1 measure (1 drachm by weight) as supplied by the manufacturers, to 1 fluid oz. of water. The chief disadvantage in connection with their use is that the carbohydrate balance is upset if they are supplemented with starchy or farinaceous foods, when, as is usually the case, such additions are indicated in the later months of infancy. It should be specially noted that in using dried milks the chief merit of such preparations is lost if each feed is not made up immediately before use. The making up of the whole day's supply, which is occasionally recommended, introduces opportunities for bacterial contamination, and deprives dried milks of their chief virtue.

D. CONDENSED MILKS

In my experience condensed milks can be extremely valuable substitutes for breast milk in the feeding of premature, new-born, and delicate babies. They also have their uses for normal healthy babies. Their value lies mainly in their superior digestibility. The casein molecule, the really indigestible element in milk, is so shattered by the prolonged heating to which milk is subjected in the process of condensation that it readily tumbles to pieces under the catalytic influences of pepsin and hydrochloric acid in the stomach of the infant. Condensed milks are indeed so highly digestible that most infants, even those only a few weeks old, can consume them with impunity without any dilution at all, and in this manner we use them very largely for special cases of vomiting at The Infants Hospital, the necessary water being given separately and independently some hours later.

There is however one difficulty which applies to the use of all varieties of condensed milk, and that is, in connection with the accurate measurement by volumetric means. For accuracy, they must be measured by weight on delicate scales. One ounce by weight of ordinary sweetened condensed milk has a Caloric value of 100 Calories. With this knowledge it is comparatively easy to provide the required number of Calories for any infant whose weight is known, if its requirements are estimated on a basis of 50 Calories for every pound weight. For instance, a normal baby weighing 12 lb. has a daily requirement of 600 Calories, that is to say, 12×50. These requirements will be satisfied by 6 oz. (by weight) of condensed milk divided up among the required number of feeds. The degree of dilution is not of importance from the point of view of digestibility, but it must be such as to satisfy the bodily requirements for water.

Sweetened Condensed Milk. Ordinary varieties of sweetened condensed milk contain quite a large proportion of cane sugar added for the purpose of preservation. This renders the carbohydrate balance somewhat excessive—a fault, however, which can be compensated for by the independent addition of some suitable fat emulsion such as Vitoleum Cream. Condensed milks are also highly scorbutic foods. It is extremely important therefore to give independently a good supply of orange juice or its equivalent. With these two precautions, sweetened condensed milks can be used with confidence as an exclusive food for infants during the first 6 months of life. After that age it is probably wiser to change gradually over to a suitable cow's milk modification or to one of the dried milks in order that the

digestive functions may be better developed by having more work to do.

The following Table gives the percentage composition of certain of the well-known brands. It will be observed that they differ very little in composition except as regards their fat content.

TABLE VI

SWEETENED CONDENSED MILKS

Food.	Water.	Salts.	Fat.	Protein.	Carbohydrate.	When diluted 1 drachm to 6 drachms of water by weight.		
						Fat.	Protein.	Carbohydrate.
Borden's Eagle Brand . .	25·66	1·78	9·61	8·01	54·94	1·6	1·3	9·15
Milkmaid Brand	23·7	2·3	11·0	9·7	53·3	1·8	1·6	8·8
Nestlé's . .	22·8	1·6	13·7	9·7	52·2	2·28	1·6	8·7

Notes.

In Borden's Eagle Brand, of the total carbohydrates 42·81 per cent is cane sugar, and 12·03 per cent is lactose. Caloric value 100 per oz.

In Milkmaid Brand, of the total carbohydrates 38·7 per cent is cane sugar, and 14·6 per cent lactose. Caloric value 100 per oz.

In Nestle's, of the total carbohydrates 37·2 per cent is cane sugar, and 15 per cent lactose. Caloric value 108 Calories per oz. (undiluted).

Unsweetened Condensed Milks. These milks have the advantage over the sweetened varieties in that they contain no added cane sugar, and consequently are not unduly sweet. Milk sugar or any other form of sugar required can be added in the necessary quantities to bring the balance up to any desired standard.

The Calorie values of unsweetened condensed milks range between 50 and 60 Calories per ounce, so that to afford the same number of Calories as sweetened condensed milk they must be given in nearly twice the amount.

These milks may be used in exactly the same way as the sweetened varieties—that is to say, with as much or as little water as may be thought desirable. In fact, they may be given without any water at all in those cases in which limitation of water is indicated. The latter may be given independently as in the case of the sweetened varieties. Orange-juice must be given in full amount owing to the scorbutic properties of these milks.

The following Table gives the percentage composition of certain of the well-known brands.

TABLE VII

UNSWEETENED CONDENSED MILKS

Food	Water.	Salts.	Fat.	Protein.	Carbohydrate.	Percentage composition after reconstitution in proportion of 1 part by weight of milk to 3 parts by weight of water.		
						Fat.	Protein.	Carbohydrate.
Ideal Milk. .	62·0	1·3	12·4	8·3	16·0	4·1	2·7	5·3
Hollandia . .	57·0	3·4	9·8	11·3	18·5	3·26	3·76	6·1
Borden's Evaporated Milk .	73·27	1·43	8·1	7·15	10·05	2·7	2·3	3·3

E. EVAPORATED MILKS

Evaporated milk, which is included in Table VII, is little used in this country, but in America it has a greater vogue. It occupies a position midway between condensed milks and dairy milk, and may be regarded either as a very rich milk or a very thin cream.

Uses of Evaporated Milk. Borden's Evaporated milk, the variety mentioned in the foregoing Table, is practically three times as concentrated as ordinary dairy milk, so that if diluted with water in the proportion of one part of Evaporated milk to two parts water, the percentage composition will not be greatly different to ordinary dairy milk. Owing to the prolonged subjection to heat in the process of evaporation it is not only sterile but also more digestible. It is indicated for the same sort of cases as those for which condensed milk is prescribed. It should be fortified with additional sugar.

F. PROPRIETARY PREPARATIONS

It is impossible to keep pace with the ever-increasing number of these foods. The majority of them are quite unnecessary, since the results at which they aim can usually be obtained by

the intelligent manipulation of cow's milk, by the addition of sugar, cream, starch, or one or other of the accessory factors. It is a great mistake to try one variety of proprietary food after another in the hope of finding one which will agree with the baby and fulfil the necessary conditions. The merits of certain of those foods often depend on some peculiar property which makes the food suitable in certain abnormal conditions of digestion or nutrition, merits which however may make them quite unsuitable for average healthy infants.

Proprietary foods may be classified in various categories. One class may be considered to include complete foods which can be substituted for breast milk without modification and without additions except water, and a second class to include those which are intended to be merely supplementary additions to ordinary cow's milk, such as malted foods, sugars, synthetic creams, vitamin preparations, and other accessory food factors.

(1) Complete Foods

This class includes the dried milks which have been previously described under proprietary names in Tables III, IV and V, as well as such foods as the Allenbury foods, Almata, and certain others.

Advantages. These foods are very simple to use since they merely require reconstruction with water in the proportion of 1 drachm by weight to 1 fluid oz. of water. Most of them are easier to digest than ordinary cow's milk modifications, and are practically sterile.

Disadvantages. Owing to the great difficulty of compounding any single food in such a way as to contain every one of the necessary constituents in exactly the right proportion, it is undesirable that any infant should be fed indefinitely and exclusively on any one of these foods. Any single defect, however trivial, becomes important if persisted in for any length of time. For this reason I do not recommend the protracted use of any of these foods, no matter how well their formulas are devised. Variety in such cases is of great importance, so that the defects of one may be compensated for by the merits of another. The chemical constitution of these foods is given in the Table on opposite page.

(2) Supplementary Foods

(intended as additions to cow's milk modifications)

Carbohydrate Additions.

In order to secure a correct balance in cow's milk modifications, it is essential to supplement the mixtures with some additional

TABLE VIII

Proprietary Preparations (Complete Foods)

	Calorie Value per oz.	Percentage Composition.			Notes.
		Protein.	Fat.	Carbo-hydrate.	
Allenbury's No. 1	134	9·7	20	60	Extra vitamins essential.
,, No. 2	121	9·2	15	69	Extra vitamins essential.
Almata	145	12·5	27	54·6	A complete food easily digested—useful in vomiting and cases of hypochlorhydria.
Condensed milk (sweetened), *i.e.* Nestlé's	100	9·7	13·7	52	Dilute about 1 in 5 or 6. Requires vitamins.
,, ,, (unsweetened), *i.e.* Ideal	60	8·3	12·4	16	Requires sugar and vitamins. Can be variously diluted about 1 in 3 or 4.
Cow and Gate Milk food—Full-cream	140	27	26·6	37	Requires modification.
,, ,, ,, ,, Half-cream	120	20	15	58	Requires much modification.
,, ,, Humanized	145	13·7	26	54·7	
C. & G. lactic acid milk. Lacidac full-cream	145	25	25·5	35·2	Lactic acid milk (dilute 1 in 9).
,, ,, ,, ,, Lacidac half-cream	129	28·3	15·5	41	,, ,, ,, ,,
,, ,, ,, ,, Lacidac separated	104	33	0·7	49	Contains no fat.
Dried milks—Full-cream : average composition	140	25	23	34	
,, ,, Humanized	141	12	26	52	
Glaxo—Full-cream Ostermilk No. 2	140	24	26	38	
,, Sunshine or Ostermilk (humanized)	137	17·4	19·4	56	When diluted 1 in 8 makes a good substitute for breast milk for infants over fourteen days old.
Tru-food—Humanized	152	12	28	52	Contains added iron. Dried by spray process.
Tru-food—Full-cream	147	27	26	39	Dried by spray process.

carbohydrate food. The choice lies between the soluble varieties, namely, sugars; the insoluble varieties, consisting of unaltered starch; and mixed varieties, which are partly soluble and partly insoluble, which include the dextrinized flours.

Soluble Carbohydrates or Sugars. Among the available sugars are the following: Milk sugar (lactose), cane sugar (sucrose), malt sugar (maltose), and glucose (dextrose). There are other varieties such as fruit sugar (fructose) or levulose, but these are either too expensive or too difficult to obtain to be included among the available sugars.

Milk Sugar. This is the natural sugar for infants, since it is the only one contained in breast milk. It is a polysaccharide sugar and is not available for utilization by the tissues without digestion. Under normal conditions it is inverted or digested by the enzyme lactase, and broken up into its monosaccharide fractions—galactose and dextrose. This enzyme (lactase) is invariably present in the digestive juices of even the youngest baby.

One great advantage of the use of this sugar in contra-distinction to other sugars, especially in the feeding of young babies, is that it is very easily broken up into its component lactic acid molecules by lactose fermenting bacteria, which so readily gain entrance to, and are usually present in the stomach and digestive tract of the youngest infant. The presence of a limited amount of lactic acid in the stomach has a beneficial influence on peptic digestion, since it helps to raise the *p*H of the gastric juice to that degree of concentration which is necessary for the activation of the ferment pepsin, and further, it helps to restrain within limits the multiplication of proteolytic organisms. In my opinion milk sugar should be the carbohydrate of choice for the supplementation of all milk mixtures for new-born infants.

Cane Sugar. Cane sugar is also a polysaccharide sugar, and as such must be inverted by its own specific enzyme—invertin, into its monosaccharide fragments, dextrose and levulose, if it is to become available for nutritional purposes. It is a suitable sugar for all infants excepting the new-born, who as a rule possess very little of this ferment in their alimentary tract. The quantity of invertin, however, rapidly improves if the amount of cane sugar is judiciously increased, but if the latter is given in excess beyond the limits of inversion, it is attacked by fermentative organisms and converted into acid bodies, with irritating qualities.

Malt Sugar. This is also a polysaccharide sugar, which under normal conditions of digestion is inverted under the influence of the enzyme maltase into the monosaccharide variety—dextrose:

it has won for itself the somewhat undeserved reputation of being less liable to undergo undesirable fermentative changes than other sugars, and also as having laxative properties. Malt sugar is a good sugar to give babies from the first month onwards, and as a means of helping the evolution of their digestive powers. Pure malt sugar is a somewhat expensive sugar to employ, but can be quite suitably given in its cheaper forms in which it is combined with dextrin bodies. In this form it is sold as Mellin's Food, Dextri-Maltose, and Malto-Dextrin.

Glucose. Glucose, which is only another name for dextrose, is the same monosaccharide sugar as that into which all starches, and most polysaccharide sugars, are wholly or partially converted in the normal processes of digestion. It is in fact a completely digested carbohydrate food, but it has no specific virtue or property peculiar to itself, and it has the special defect that it does not require and does not encourage independent carbohydrate digestion on the part of the infant. Its rational use is for intravenous or subcutaneous injections. It can also be given in those cases in which the infant has no powers of independent carbohydrate digestion.

Insoluble Carbohydrates. All starches belong to this group, but pure starches are not generally available. They form the main basis of most cereal and farinaceous foods. They are usually given to babies in the form of barley or wheaten flours which have been boiled and thereby rendered glutinous or colloidal.

The digestion of starch takes place in two stages : firstly, it is converted into malt sugar by a diastatic ferment contained both in the saliva (ptyalin) and in the pancreatic secretion (amylopsin), and, secondly, by the inversion of the maltose by the enzyme maltase, thus producing dextrose in the manner described on page 58. The conversion of starch into maltose is greatly facilitated by cooking, and also when in the solid form by mastication.

New-born infants have at first a very limited capacity for digesting starch, but they soon acquire the power if given favourable opportunities, that is to say, if they are gradually educated in the function by an appropriate increase in the quantity supplied. There is no fixed age at which an infant begins to be capable of digesting starch, or at which starch should be first given, but it may be assumed that if weak decoctions of barley water are given at or about the second month this will not be too early to begin the education, and from that time onwards starch in various forms may be substituted weight for weight for the soluble carbohydrates. Later on the infant may be given dry

varieties of starch in the form of rusks or biscuits which demand mastication.

In Table IX on the opposite page are given the percentage compositions, caloric values and uses of a miscellaneous collection of foods commonly used in infant feeding.

Synthetic Creams. It is usually necessary to make some addition of fat to ordinary milk dilutions in order that the correct balance may be obtained. Fats are very essential food elements for infants, partly because they are the only natural and available vehicles for supplying the fat-soluble vitamins, and partly because they are the exclusive source of roughage (see page 7). Ordinary dairy creams are usually employed for this purpose, but their very variable fat content is an objection to their use where accurate percentage feeding is indicated, moreover, the butter-fat in cow's milk is chemically, physically, and biologically different to that of human milk and not nearly so suitable for an infant's digestion and nutrition, and further, dairy creams, like ordinary butter, are even more dangerous from the point of view of infection by tubercle bacillus than milk itself, and they are more difficult to sterilize.

Fats are commonly regarded as one of the most indigestible of the constituents of milk, but as a matter of fact the troubles connected with their consumption by infants lie not so much in their intrinsic indigestibility as in the interference which they exercise on the digestion of other constituents, mainly, the casein. It is relatively easy to compound out of different oils a synthetic cream with properties very closely analogous to those of human milk, and this has been very successfully carried out in the case of Vitoleum Cream, though less successfully in some of the other synthetic creams on the market.

Cod-liver oil, olive oil, cocoa-nut oil, linseed oil, or cotton-seed oil, cannot be regarded as good substitutes for human butter-fat, or even for dairy cream, although in certain combinations they may be better adapted for infant feeding. The following are some of the better-known synthetic creams:

Vitoleum Cream : This, as already mentioned, is the most like human cream.
Marylebone Cream :
University Cream :
New Zealand Cream : Contains sugar.
Brestol : . . . Of the consistency of butter.

(These creams contain from 30 to 50 per cent of fat. Vitoleum Cream is sold in two strengths, 33 per cent fat and 50 per cent fat.)

Miscellaneous Preparations.

There are available at the present time a great many proprietary preparations, far too numerous to give in detail, which

TABLE IX

Miscellaneous Foods used in Infant Feeding

	Calorie Value per oz.	Percentage Composition.			Notes.
		Protein.	Fat.	Carbo-hydrate.	
Albumen water	2	1·8	a trace	a trace	A " placebo."
Allenbury's No. 3	110	9·2	1	82·8	A farinaceous addition to milk.
Barley water (from Pearl Barley)	2	0·09	0·05	1·63	
Barley water from prepared barley can be made of any strength with corresponding percentage composition.					
Beef tea	2	1	a trace	a trace	A stimulant.
Benger's Food	101	10·2	1·2	79·5	Contains important enzymes. Should not be made at a higher temperature han 117° Fahr.
Bone and vegetable broth	3	—	—	—	Contains vitamins, extractives and salts.
Bread jelly	18	2·7	0·5	15·2	In combination with cream, plus beef juice constitutes Dr. Cheadle's famous mixture.
Cod Liver Oil Emulsion	88	—	33·3	—	
Cow's milk	20	4	4 (3–4)	4 (4–5)	Requires modification.
Cream—thick (centrifugal)	131	4	50	4	
,, thin (hand-skimmed)	52	4	20	4	
Hoos Albumen Milk	100	39	32·5	19·5	A lactic acid milk for diarrhœa, for temporary use only.
,, diluted 1 in 13	—	3	2·5	1·5	
Horlick's Malted Milk	120	13·8	9	70·8	Requires vitamins. A good temporary food when there is intolerance of fat.
Human milk	20	1·76	3·5	7	
Lactose	116	—	—	100	
Mead's Protein Milk	100	37	30·9	19·1	For diarrhœa.
Mellin's Food	105	8·9	0·18	82·6	Practically dextrin and maltose.
Neaves'	106	9·2	1	81·2	Practically flour.
Raw meat juice	6	5	a trace	a trace	
Ridge's Food	108	9·2	2·71	83·14	Practically flour.
Savory and Moore's Food	106	9·6	0·4	81	A carbohydrate addition to milk.
Sister Laura's Food	90	18·9	2·6	60	Practically baked flour ; use with caution.
Skim milk	14·15	3·2	1	4·5	
Vitoleum Cream, 50 per cent.	131	—	30 & 50	—	Closely resembles human cream.
Whey (fat free)	6–10	1	—	0·45	
,, (fatty)	13·3	0·95	2	4·7	
,, (dry)	100	13·25	0·3	74	

are designed to fulfil specific nutritional needs in infant feeding. For instance, there are all the various vitamin preparations, and extractives, which are intended to compensate for corresponding deficiencies in milk dilutions.

Vitamin A. This vitamin is fat-soluble and may be obtained in a pure state as carotene, which though not exactly identical with vitamin A, is converted into it in the animal body. Carotene may be obtained in tabloid form (Burroughs Wellcome & Co.), one of which contains 0·002 mg. ($\frac{1}{32}$ of a grain approx.), and the dose for a baby is 1 tabloid three times a day. It may also be obtained in concentrated form in combination with vitamin D as Haliverol (Parke Davis & Co.), or as Adexolin (Glaxo Laboratories), or as Crooke's Organon. For further particulars and natural sources of vitamin A, see page 88.

Vitamin B_1* and B_2. These vitamins are not as yet on the market in absolutely pure form, but as concentrates they are available in all of the following preparations:

1. Marmite: particularly rich in vitamin B_2. The dose is approximately 30 drops three times a day in milk.
2. Yeast tablets (grains 5 approx.). Dose 1 tablet three times a day.
3. Yestamin (powder) (The English Grains Co. Ltd.) contains both vitamin B_1 and B_2. Dose 15 grains three times a day.
4. Yestique (tablets) (The English Grains Co.). Dose 1–3 tablets three times a day.
5. Bemax. Dose $\frac{1}{2}$ teaspoonful three times a day.

For further particulars of dosage, etc., see page 91.

Vitamin C. This can now be obtained in pure form as ascorbic or hexuronic acid. It is sold under the trade names of Paprica and Redoxon tablets (Hoffmann La Roche Laboratories). Each tablet of Redoxon contains 50 mg. of ascorbic acid. The dose is 1 tablet once or twice a day.

Orange-juice concentrates can also be obtained, one of them being sold under the proprietary name of "Sunkist" (Allen & Hanbury), which consists of Californian orange juice concentrated *in vacuo* to about one-fifth of its original volume. The dose of this is about 1 teaspoonful daily. It is well tolerated, rather better, I think, than fresh orange-juice (see page 96).

Vitamin D. This is the anti-rachitic factor, and can now be obtained in a pure crystallized form of Califerol. It is also sold as Ostelin, Ostelin Tablets, and Ostelin Emulsion (Glaxo Laboratories). Crooke's Organon contains 10,000 international units of vitamin D per c.c. Radiostol (British Drug Houses) contains

* Recently made synthetically by Bayer and sold under the name of Betaxan.

1,000 units per c.c. The dose of the latter is 3–5 minims t.d.s. It is also contained in concentrated form in Cod-liver oil, Halibut-liver oil, and Haliverol.

Preparations containing Vitamins, Extractives, Mineral Elements, Etc. Roboleine, Virol, Vitmar, Multivite pellets (B.D.H. Ltd.), Minadex (Glaxo Laboratories), Bickiepeg Broth, and Bone and Vegetable Broth (see page 708), are all useful additions to milk dilutions. They contain variable quantities of vitamins, extractives, and mineral elements.

CHAPTER IV

FEEDING OF CHILDREN FROM 1 TO 5 YEARS OF AGE

The feeding of young children is comparatively simple so long as milk constitutes the main part of their diet, for in milk itself are represented all the various elements of a complete and perfect food. Difficulties immediately begin however when we commence to substitute solid and other varieties of food for the fluid which Nature has successfully devised for the nourishment of the nursling.

The milk of all mammals contains a great many more elements than was at one time supposed or suspected; it is not a mere mixture of proteins, carbohydrates and fats. There are in addition many other elements, each of which has its specific use in the development or maintenance of the body. These elements consist of a great number of different mineral salts, extractives, vitamins, enzymes, and oxidases, etc. Nature is not so prodigal as to supply any superfluous elements, or so careless as to omit any that are essential.

The responsibility and difficulty of finding satisfactory substitutes for milk are therefore obviously great. There was a time, and that not so very long ago, when we thought we had fulfilled all the requirements of nutrition when we combined with water certain proportions of protein, carbohydrates, fats, and salts. We did not know then, as we know now, that the organism cannot make use of these elements for the purposes of growth, energy-production or secretion, without the co-operation of certain accessory substances, among others the so-called vitamins. We know also that there are present in milk many other unconsidered trifles which produce effects totally out of proportion to their quantitative representation.

In the building up of the animal body we require a number of accessory materials beyond the staple articles of diet; and we require others for its maintenance and for elimination and excretory purposes. No dietary can be considered physiologically correct which omits any of these. No child can live long if he is

completely derived of his three staple articles of diet, namely, proteins, carbohydrates and fats; perhaps in the absence of all of them he might live 2 or 3 weeks if he had a sufficiency of water, salts, and all the other accessory factors. If he were deprived of water he would die in a few days; if deprived of all salts or mineral elements he would rapidly perish; if he obtained no vitamins he would die in a few weeks although everything else were provided in abundance.

The question may reasonably be asked, why, if milk is so perfect a food, and if a complete substitute for it is so difficult to find, we should be at such pains to make a change when the child reaches 1 year old, and to substitute for milk a combination of a great number of new and strange foods. The answer to this question is that though the mother's milk may be a perfect food for the young baby before he has teeth, and before his functions of digestion are fully developed, it is not a flawless food, even if it were always available, when he reaches a stage at which he can masticate, and at which his stomach and intestines are clamouring for the exercise of new and more active functions. But all the same, milk, whether it be derived from the cow or from any other mammal, still possesses very great virtues from the nutritional point of view, whether it be consumed by the child, the adolescent or the adult, and at no time of life is it wise to abandon it entirely as a food, for it is one of the best means of ensuring that, even if the individual is otherwise incorrectly fed and ill-provided as regards one or more of the essential accessory factors, he is still supplied with some representation of all the food elements that are necessary for life.

Proteins.

Among the essential elements for nutrition, first and foremost come the proteins, or the albuminous elements of the food, so called from the Greek word "Protos," which means first, because of all necessary constituents of a dietary they are the foods which are the most important, and constitute the main organic basis out of which all the tissues of the body are built up. They are the bricks and mortar out of which the animal edifice is constructed.

There are many different varieties of proteins, some derived from animal and some from vegetable sources. Some are far more valuable than others for the building up of human tissues; no proteins are so good for the infant as those which are represented in mother's milk. The proteins of cow's milk are, from a nutritional point of view, nearly as good, and would be better than they actually are if the predominant one, namely casein, was not so indigestible. Many other proteins, such as those of meat or

fish, would answer nearly as well for the nourishment of the human baby if they did not happen to be solid, and thus inadmissible at a time of life when only liquids can be consumed.

On the other hand the proteins of egg, both in the white and in the yolk, are, in the raw state, liquid, and so are those which can be expressed from meat; so that white of egg, yolk of egg, and meat-juice are possible substitutes for the proteins of milk even for the young baby, but more suitably so when the child is a little older.

A certain quantity of inferior and insoluble proteins are also contained in cereals, and also in those farinaceous foods which are commonly used for making milk puddings.

The total amount of proteins required by the child when he is 1 year old, is about 1 oz. in the 24 hours, but the exact quantity will depend on the quality and make-up of the protein employed. This quantity is provided by about 25 oz. of cow's milk; by about 10 oz. of bread; 6 oz. of lean meat; 6 oz. of egg, or about 12 oz. of fish. It is obvious that a child of this age could not be expected to obtain his total protein ration from any single source of this kind with the exception of milk. It is equally obvious that if he were to consume as much milk as 25 oz. he would not require to have his protein intake supplemented from any other source. For this reason, at this age the milk ration should be limited to about 1 pint, leaving about a quarter of an ounce of protein to be provided from outside sources, such as bread, egg, and possibly meat or fish.

Since no two proteins are exactly the same, nor any except those of milk exactly adapted to human requirements, it is advisable to derive the protein supply from a variety of sources, so that the defects of one may be compensated for by the different qualities of others. In certain respects the proteins of the internal organs, such as the liver, the kidneys, sweetbread and brain are of value to the organism, since they are of a very specialized kind, which may be required in small quantity for the building up of similar tissues in the growing child. So-called offal may, therefore, be given to children and grown-ups with, as we now know, the greatest advantage, but it is never required in any considerable quantity.

Vegetarians are at a great disadvantage as compared with more orthodox feeders, for they must either consume unnecessarily large quantities of vegetable proteins, or else suffer from a deficiency of some essential amido-acid of which proteins are built up. Excess and not lack of protein food, however, is one of the troubles of civilization, and especially among the well-to-do

classes. Children who consume 2 pints of milk a day in addition to other protein-containing foods, will be the victims of an excessive protein dietary, the results of which I need not enter into here. Science knows of no advantage to be derived by a child taking a higher percentage of proteins in his food, provided they are of the right kind, than is contained in breast milk, which is a perfectly balanced food. As the child grows older and larger he naturally requires a larger total of proteins, but not greater in proportion than heretofore. At 1 year, as I have already said, he requires about 1 oz. in the 24 hours, and at 5 years he requires nearly double that amount, and during the intermediate years, quantities which are proportionately adjusted to his weight and the requirements of upkeep and repair.

Carbohydrates.

The diet of children of all ages should consist largely of carbohydrate food in some form or other; in human milk it is represented in the form of milk sugar, and is present to the extent of 6·5 per cent, that is about four or five times as much as the protein representation. This ratio does not require to be altered as the child grows older, unless he is very active, when proportionately larger quantities of carbohydrate may be given. This means that at 1 year the amount should be between 4 and 5 oz. and at 5 years between 6 and 7 oz. in the 24 hours.

Carbohydrate foods are usually classified as being of two kinds :

1. Soluble. 2. Insoluble.

To the former class belong all the sugars—Cane sugar, Fruit sugar, Malt sugar, Milk sugar, and Glucose.

To the latter class belong all varieties of starches, such as are represented in bread, potato, oatmeal, sago, tapioca, etc. Since starches are insoluble in water, and consequently incapable of being absorbed directly into the blood, if they are to be absorbed at all, they must first be converted into some soluble variety of carbohydrate—*i.e.* into some form of sugar.

The food values of starches and sugars are identical so long as the former can be converted into sugars by the processes of digestion. The young baby is incapable of converting any considerable quantity of starch into sugar, and hence his carbohydrate ration must consist chiefly of the soluble variety, but as he grows older and his digestive functions develop, he can convert to his use larger and larger proportions of starch. At 1 year of age, he should be able to take the two varieties of carbohydrates in equal proportion, and at 2 years he ought to be able if need be to dispense with sugar altogether.

It should be thoroughly understood that cane sugar is not a

necessity for the child, but a luxury or a condiment, at any rate, after 2 years of age. Starch is cheaper, it is more satisfying to the appetite, and if properly digested it reinforces the blood with sugar at a steadier rate than the ready-made soluble carbohydrate. When children eat large quantities of sugar, owing to the fact that the latter is almost ready for absorption, the blood is liable to become flooded with it and over-saturated, so that some of it has to be excreted by the kidneys, producing a temporary condition of glycosuria. Owing to the erroneous belief that sugar, and particularly glucose, is a cure for acidosis, there has sprung up a most pernicious fashion of giving all children who are supposed to be suffering from this condition, unlimited quantities of either glucose or barley sugar. This practice is a bad one. In the first place, because sugar is not a rational method of treating acidosis, even if it exists (see page 316), and in the second place, because the symptoms which are usually attributed to acidosis are in the vast majority of cases due to a breakdown of liver function, for which starvation rather than food is the rational method of treatment.

As already mentioned, it is better, when the child has teeth, that these teeth should be exercised in masticating than that the food should be given in the form of slops. One of the consequences of our national predilection for pappy food, such as porridge, bread and milk, gruels and milk puddings, is that, as a rule, English people have bad teeth and contracted jaws. In spite of popular opinion, porridge is, in one respect at least, a very poor food for young children, for it is usually swallowed without mastication, and thus fails to promote the development of the jaws. If there were any particular virtues in oats over good wheat, this might be an argument for the employment of oatmeal bread, or oatmeal biscuits, instead of ordinary wheaten bread or biscuits, but it would still be no argument for the consumption of porridge. As a matter of fact, there is no better cereal than ordinary good wheaten flour made into good bread, and it is still further improved by toasting, for it thus becomes harder and gives more work for the jaws.

Fats.

Fats represent the third of the trio of energy-producing foods, and they possess very important qualities. Nature ensures in human milk a very ample supply of fat for the nursling, in fact, no less than 3·5 per cent, as compared with 1·5 per cent of protein. If at the age of 1 year the child were to require the same proportion of fat as during the first 9 months or so, he would need nearly $2\frac{1}{2}$ oz. in the 24 hours. We know, however, by experience that

young children after the first year of life do better with a smaller proportion of fat and a higher proportion of carbohydrate. Why is this ? I do not know that any adequate or complete explanation has been offered for this anomaly, but I have been driven to the conclusion that one of the reasons is that babies who subsist on milk alone cannot obtain their fat-soluble vitamins from any other source than cream. So they must have a good supply of it, whereas older children who consume variable quantities of green food can obtain at least part of their supply of these vitamins from these alternative sources.

Another very important reason why infants require such a large proportion of fat is because the latter is their only source of roughage. Soap is the only form of roughage present in an infant's stool, and it cannot be derived from any other source than fat. Hence the necessity for the apparent excess of fat in human milk. If there were no excess of fat to form roughage, the stools would consist mainly of mucus, and become in consequence too liquid and too frequent.

When a child is about 1 year old, he requires approximately $1\frac{1}{2}$ oz. of fat in the 24 hours, and at 5 years about $1\frac{3}{4}$ oz. Since 1 pint of cow's milk contains something like $\frac{3}{4}$ oz. of fat, if a child of 1 year consumes this amount of milk he must make up the $\frac{3}{4}$ oz. deficit from other sources—from butter, dripping, bacon fat, or cream. Bread, meat, and vegetables all contain negligible quantities of fat. Vegetable fats, such as olive oil, nut oil, and other oils from which margarine is usually manufactured, are from the energy-producing point of view or as roughage as valuable as animal fats, but they are deficient in the fat-soluble vitamins ; [1] so that if these vitamins are not obtained from green vegetables or other sources, the child must depend for his vitamin ration exclusively on animal fats. Of all oils, halibut liver oil is probably the richest in vitamins, while cod liver oil, butter, and oleo-fat (the oil which is expressed from beef suet) come next in order of merit.

Salts or Mineral Elements.

Next in importance to the energy-producing elements in the dietary come salts or mineral elements, and the vitamins. The functions which these food constituents fulfil in the animal economy are multifarious and complex. In breast milk mineral elements are well represented ; the daily allowance at the age of 9 months is about one-tenth of an ounce of mixed salts consisting of sodium carbonate, sodium citrate, sodium chloride,

[1] Unless specially treated.

potassium carbonate, potassium chloride, calcium phosphate, as well as various other combinations of magnesium, iron, fluorine, phosphorus, sulphur, and iodine. Each salt as well as each metallic element has its own particular use—none are superfluous or unnecessary.

When the child's dietary ceases to consist largely or entirely of milk, there is considerable risk of mineral starvation. If a child 1 year old were to live on bread and butter alone he would have to eat about 12 oz. in the 24 hours to supply the minimum amount of mineral matter for safety, and even then the salts would neither be of the right kind nor in the right proportions. If his sole source of mineral elements were meat he would have to eat a similar amount. When we remember that neither sugar, nor starch, nor fats contain any mineral elements worth considering, it becomes obvious how serious the danger of mineral starvation is when neither milk, fruit, nor vegetables constitute any considerable proportion of the diet.

There is no single article of diet which can provide all the required salts with the exception of milk; in some foods one kind of salt may be well represented, in other foods salts of a totally different kind, and for this reason alone, change and variety of diet are essential. In potatoes, for instance, there is a fair proportion of potassium, in spinach a rich content of sodium, in milk of calcium, in strawberries of iron, in fish and marine vegetables of iodine, and so on. Of all vegetables, spinach is the richest in mineral elements, and of all animal foods milk.

The one salt which is almost invariably supplied in adequate amount is common table salt or sodium chloride. But since a correct balance in salts is as requisite as a correct balance in respect of other elements in the dietary; an excess of salt is a defect of a serious nature.

The chief safeguard against mineral starvation is the supply of an ample allowance of fruit, vegetables, and milk. It should be remembered that vegetables can be rendered almost salt-free by boiling in water, and for this reason vegetable soups are particularly valuable. I am in the habit of making considerable use of soups and broths made from bones and vegetables. The mineral elements of the bones can be brought into solution by the addition of a little vinegar which dissolves out certain of the salts and sets others free. Quite a small addition of such soup to the daily dietary is a very wise precaution to guard against mineral starvation, and it has another distinct advantage in that it supplies a number of other accessory factors (see page 708).

Quite apart from food sources, mineral elements can be sup-

plied in the pure form of drugs or medicines, and administered in this way they undoubtedly have value, but it is a great mistake to administer any particular salt such as citrate of soda, or bi-carbonate of soda, to the exclusion of other varieties, for by so doing the mineral balance is liable to be upset. If the salts are given at all they should be mixed,[1] but it is better still to depend on fruit and vegetables as the sources of supply.

Vitamins.

The greatest advance yet made in dietetics is undoubtedly connected with the discovery of the vitamins. We cannot discuss either the history of their discovery, or the chemical and physical nature of their composition, but it may be sufficient to say that these somewhat intangible, elusive, but altogether indispensable bodies, are very widely distributed among natural food products. Under present conditions of life in crowded cities, the majority of people live on a diet which contains only a small fraction of the vitamins which are normally present in fresh foods, and which are entirely or partly removed in course of preparation or preservation. The almost universal shortage of these essential substances may account for many conditions of ill-health which are otherwise difficult to explain among town-dwellers.

Although it is not easy to demonstrate the presence of these bodies in food, otherwise than by their physiological effect on those who consume them, it is possible nowadays to recognize by the symptoms produced, the specific nature of the vitamin insufficiency and to prevent it. There can be no doubt that most of the so-called deficiency diseases which are caused by a shortage of vitamins are usually composite, and due to a shortage of more than one of these accessory food factors. Another fact which has emerged from our better knowledge of the action of vitamins is that any deficiency of them has a remote and cumulative effect on successive generations, so that the stock affected becomes progressively more and more pathological.

The origin of the accessory food factor—vitamin D—is plant life—mainly the chlorophyl-containing plants, which are dependent for their growth on the presence of the sun's rays of certain length. Animals are therefore dependent either directly on vegetable foods for their supplies of vitamins, or indirectly on the tissues of animals in which vitamins derived from vegetable sources have been stored up. An instance in point is the livers of certain fish, such as the cod and halibut, which are particularly rich in vitamins, owing to the fact that these fish consume large

[1] Messrs. Parke Davis & Co. have prepared to my formula a combination known as NUTRITIVE SALTS (see page 696).

quantities of chlorophyl-containing algæ or diatoms, and store the vitamins derived from them in their livers.

Various names have been given to the different varieties of vitamins, usually based on their therapeutic properties—such, for instance, as the anti-rachitic vitamin, the anti-beri-beri vitamin, or the anti-scorbutic vitamin, but a simpler form of nomenclature, and one easier to remember is that based on an alphabetical designation, namely, A, B, C, D, and E. Further particulars of these vitamins will be found in the chapter which deals with deficiency diseases (see pages 85–112).

Extractives.

As already explained, there are a number of miscellaneous substances in milk and other foods which are neither energy-producing elements, vitamins, nor salts, but yet play certain indefinite rôles in the maintenance and upkeep of the animal body. Some of these are included under the term extractives. There are both animal and vegetable extractives, and both classes are dissolved out of the foods which contain them in the making of broths, soups, decoctions and infusions. At one time, and that not so very long ago, there was a strong prejudice against meat extractives, such as beef tea, and so-called meat essences. They were said to produce gout and uric acid troubles, and to stimulate rather than nourish the tissues. It is a fact that all nuclein derivatives and so-called purin bodies are converted into uric acid by the metabolic processes and excreted as such from the body, in the urine, or in the fæces, but they have certain stimulating qualities of great value, and which do no harm unless given in excess, for uric acid is a normal constituent of the urine.

It is a good plan to give all children small quantities of meat, bone, or vegetable soups, but they are not required in large quantities, nor need they be supplied every day.

Digestibility.

The student of dietetics should draw a sharp line of demarcation between the digestive qualities of a food and its energy value. A food may be very digestible and yet have a very low energy value, as, for instance, calf's-foot jelly or vegetable marrow, or it may have a very high nutritive value and yet be very indigestible, as for instance, cheese or nuts.

The question of digestibility largely resolves itself into one of mastication. There are very few foods which are really indigestible if they are adequately masticated, or if they can be reduced to a condition of pulp by preliminary culinary operations before being consumed. If there is any reason to believe that a child will not masticate any particular variety of food sufficiently well

to reduce it to a condition of pulp, it should not be allowed to be eaten, or should be pulped or finely divided in the process of preparation or cooking. Bananas, for instance, from the point of view of food value are an excellent variety of fruit ; they are soft and easily masticated, and of good food value, and yet they are unsuitable for children, unless they are well mashed, because they are so slippery that large portions are apt to be swallowed before they have been divided into sufficiently small pieces.

Since mastication is the first stage of digestion, many otherwise admirable varieties of food are inadmissible for young children until the latter have learnt how to masticate efficiently, hence the sooner children are taught this essential function the better it will be for them. If young children are given such articles of diet as fish or meat in a pounded, sieved or minced form, they do not learn how to masticate, and they acquire the habit of bolting their meals ; or if they are given bread in the form of paps or bread and milk, and their farinaceous foods in the form of gruels and milk puddings, they fail to learn the useful lesson of milling solid carbohydrates with their molar teeth, organs which are specially provided for this purpose. This is bad for the future prospects of the teeth and the development of the jaws. " Jaw work " is of supreme importance to the child.

Many of the harder vegetables such as carrots, parsnips, peas, beans, celery, beetroot, etc., are contra-indicated for children in the form in which they are usually served at table, because, although invaluable as foods in many respects, they require more mastication than the child is likely to provide. This is no reason, however, why they should be entirely excluded from the diet if they are given puréed, sieved or mashed.

The best vegetables for quite young children, say at 1 year of age, are vegetable marrow, boiled cucumber, Jerusalem artichokes, Brussel sprouts, spinach, cabbage, cauliflower, and potato. At a later age, say about 2 years, when the child has learnt to masticate, there is much to be said for raw vegetables such as lettuce, tomatoes, mustard and cress or watercress ; but radishes, cucumber, beetroot and celery are not advised.

There is a popular prejudice against pastry for young children. I can see no objection to it myself, any more than I can to shortbread or biscuits. In fact, pastry is only a particular variety of biscuit, since the former, like the latter, is made from the same materials and cooked in the same way : but naturally children should not be allowed an unlimited amount of either biscuits or pastry, as they may lead to overeating owing to their appetizing qualities.

Foods which contain too much fat are said to be "bilious," or to produce biliousness in those who eat them. Fat should never be given in excess at any meal whether in the form of butter, bacon fat, cream, or even cod-liver oil, because it interferes with the digestion of both protein and carbohydrates, but fat in moderate amount is not "bilious" in itself and should be regarded as one of the essentials of a diet.

Devonshire cream often comes under the ban of prohibited articles of diet. It is, however, no more indigestible than butter, nor any more "bilious" unless it is eaten in excess. Yolk of egg is also said to be "bilious," which it certainly is if taken in large quantities. It is however such a magnificent food that all children should have a small quantity of it included in their dietaries.

Oranges are also regarded with suspicion, but there can be no less "bilious" fruit if taken in moderation and in the proper way, but taken on a full stomach an orange may be the final straw which breaks the camel's back.

Nurses and mothers should make a habit of examining the stools of children; if they do so regularly they will be surprised to find how frequently many varieties of food are swallowed without adequate mastication.

Ballast or Padding.

At the present day the whole of the civilized world is suffering from the refinements of the culinary art, which tend to make our food more and more concentrated, and to remove more and more of the coarse fibrous basis of the staple articles of diet. The compressed tabloid method of preparing food has the disadvantage that if we fill up our alimentary tract with such articles of diet, we eat more than we require for the purpose of nutrition, whereas if we consume no more food than we actually need, our stomach and intestines are not sufficiently filled or stimulated to do their work properly—we feel unsatisfied after a meal and we suffer from constipation.

Herbivorous animals possess enormous intestines, but they soon fall out of condition if they are fed on a highly concentrated food such as corn, without any coarse vegetable padding such as hay, grass, or turnips. To some extent we still bear traces of our herbivorous ancestry and possess unduly voluminous intestines. To fill up these intestines we must ensure that a considerable proportion of our diet consists of coarse vegetable matter of low nutritional value, which leaves a good residuum of soft cellulose material to constitute the basis of an adequate stool. If it were possible for a child of 2 years to live on Brussel sprouts alone, he would require about 10 lb. in the 24 hours to supply his energy

requirements, or about 20 lb. of vegetable marrow, whereas if he could live on bread alone he would require only about 12 oz. The former would fill up his alimentary tract too fully, whereas the latter would not distend it sufficiently to stimulate peristaltic movement and maintain the motor functions of the bowel. The food of children should therefore consist of a fair proportion of vegetable food of low nutritive value to serve as ballast or padding to fill space and maintain peristalsis. This does not mean that hard indigestible foods such as beetroot, celery, raw cucumber, nuts, mushrooms, or bran, should be given for the purpose of curing constipation. Such foods are far too hard and too irritating to the tender mucous membrane of the intestinal tract of the young child, but soft fibrous vegetables such as vegetable marrow, cabbage, turnips, or cauliflower, and fruits such as apples, pears, and bananas are well suited to the purpose, and should always constitute at least a part of the daily diet, but they must be well masticated.

The Total Quantity of Food.

The total quantity of energy-producing or fuel food which the child will require in the 24 hours will depend largely on the amount of energy he puts out in the form of work, as well as upon his requirements for heat, on his rate of growth, and on the amount of secretions he elaborates in his system. No two children will require exactly the same amount: all that we can say is that an average child of such and such an age, and of such and such a size, living a normal regular life will, on the average, require certain average amounts in the 24 hours. A child 1 year old requires on the average about:

1 oz. of protein food.
1 oz. of fat.
4–5 oz. of carbohydrate food (sugar or starch).

and a child of 5 years requires about two-thirds as much again.

On such quantities of food, children of these ages will be able to do all the mechanical work required of them, to maintain their normal temperature, and to grow at their normal rate, provided of course that they receive a sufficient quantity of all the so-called accessory factors.

When 1 oz. of pure protein or 1 oz. of sugar is burnt up either inside the body or outside it, it will produce a certain definite amount of heat, which is usually expressed in the convenient form of Calories. The caloric value of

Protein is 116 per oz.
of Sugar is 116 ,, ,,
and of Fat is 263 ,, ,,

so that if 1 oz. of protein or sugar is burnt in the body it will produce 116 Calories, and thus raise in corresponding degree the temperature of the child's tissue.

If a child 1 year old eats 1 oz. of pure protein in the 24 hours and 5 oz. of carbohydrates and 1 oz. of fat, and burns the whole amount in his system without loss, it will afford 959 Calories, for

1 oz. of protein	will	afford	116	Calories.
5 oz. of sugar	,,	,,	580	,,
1 oz. of fat	,,	,,	263	,,
		Total	959	Calories.

This is approximately the amount of his energy requirements in the 24 hours.

If we know the caloric value of different kinds of food we can easily estimate how much of any one of them, or any combination of them will supply the required number of Calories for the 24 hours. Breast milk and cow's milk both possess a caloric value of 20 Calories per oz. If therefore, a child 1 year old were to live on milk alone he would require $\frac{959}{20} = 47$ oz. of milk, to afford the required number of Calories.

The caloric value of dried milk is about 150 Calories per oz.; he would therefore have to consume $\frac{959}{150} = 6\frac{1}{3}$ oz. if his diet were to consist of dried milk exclusively. Condensed milk has a value of about 100 Calories per oz.; he would therefore have to consume $\frac{960}{100} = 9\frac{1}{2}$ oz., and so on with other varieties of food according to their caloric value.

The following are the caloric values of the more common foods:

Bread has a caloric value of			64	Calories	per	oz.
Oatmeal (uncooked)	,,	,,	115	,,	,,	,,
Meat (average)	,,	,,	58	,,	,,	,,
Fish (average)	,,	,,	30	,,	,,	,,
Cheese (Cheddar)	,,	,,	121	,,	,,	,,
Egg (yolk)	,,	,,	108	,,	,,	,,
Egg (white)	,,	,,	14	,,	,,	,,
Brussel sprouts	,,	,,	6	,,	,,	,,
Butter	,,	,,	263	,,	,,	,,
Sugar	,,	,,	116	,,	,,	,,
Protein (pure)	,,	,,	116	,,	,,	,,

If the chemical composition of any food is known, that is to say, its fat, protein, and carbohydrate content, it is easy to

calculate the total caloric value by estimating the combined caloric value of its constituent elements. For instance, the average composition of flour is protein 11·40 per cent, fat 1 per cent, and starch 74 per cent, + 13·60 moisture, etc.; therefore the caloric value of flour will be 102·5 (13·2 + 2·6 + 85·9) Calories.

The Times of Feeding.

An infant under 3 months of age is probably best fed at three-hourly intervals during the day, with no night feeds, making six feeds in all; and at 4 months or perhaps sooner, there should be five feeds in the day, and at 1 year, four meals. These should consist of breakfast, dinner, tea, and one additional feed, either the first thing in the morning, or the last thing at night. There are certain advantages in having only three meals, and in omitting the extra feed if so it can be arranged. The frequent feeding of young children and the giving of extra snacks between meals cannot be too strongly deprecated. Delicate children whose caloric requirements are less than normal healthy children often suffer from misguided attempts to maintain their strength by frequent feeding, and total quantitative excess.

The Water Allowance.

Children do not require very large quantities of water, unless the weather is very hot or the air very dry. They certainly derive no benefit from quantities in excess of the following:

At 1 year of age about 2 pints of fluid in the 24 hours, and at 5 years of age about 2½ pints. Since most children should have about 1 pint of milk in the 24 hours, and most foods contain a very large quantity of water, the total amount of water to be taken independently is very little more than about half a pint in the 24 hours at 1 year of age.

Psychological Aspect.

Many pages could be written on the psychology of food. In the first place, appetite and good digestion are both very much under the influence of suggestion. The child should be made to assume by various simple devices that a meal or the taking of food is something to be appreciated and an event to be anticipated with pleasure. He should be induced to believe that the food provided is good to eat, by ensuring that it is nicely served in pleasant surroundings, looks appetizing, has an agreeable smell, and is in every way attractive. The size of the helping is one of the most important elements for making a meal a success; a small helping is an invitation to "ask for more," whereas a large helping is often nauseating. Children usually hate milk puddings, bread and butter, and green vegetables, because they are told that plain foods of this kind are good for them, and because they are made

to finish their helpings when they would much rather have the foods which are forbidden them, and which they see their elders eating with relish. Attention should be paid to all these fundamental psychological factors in order to engender a taste in children for those things which are really good for them and a dislike for those which are harmful.

Summary

It will be gathered from the foregoing pages that the arrangement of the dietary of children is not so simple a matter as is usually supposed, and that the drawing up of physiological dietaries requires much technical knowledge. The following is a brief summary of the golden rules of physiological feeding:

(1) The total amount of energy-producing food required by the child at the age of 1 year weighing say 21 lb. is represented by 1 oz. of pure protein, 1 oz. of pure fat, and about 5 oz. of pure carbohydrate (sugar or starches), and these amounts afford 959 Calories, or about 45 Calories for every pound of body weight.

(2) The relative proportions of these three elements must be maintained in the above ratio throughout childhood. It is not of advantage to allow any one element to be in a preponderance.

(3) In addition to the energy-producing elements, many accessory factors of the nature of salts, mineral matter, vitamins, extractives, etc., must be supplied. No one of them can be omitted without prejudice to health.

(4) The food must be presented in a form in which it can be rendered soluble by the processes of digestion. It must also be in a form which will encourage the development of the digestive functions and the use of the teeth.

(5) The food must contain a certain proportion of ballast or padding, in order to fill up space and stimulate the motor functions of the bowels.

(6) The psychological element in feeding must not be ignored; the food must be made attractive, and be well cooked.

(7) The times of feeding should be based on the three meals a day principle.

Diet Sheets

By the time the child is 1 year old he should be able to masticate sufficiently well to take a considerable part of his total requirements of carbohydrate food in the form of bread, rusks, toast, etc. If he cannot masticate solid food, he still can take insoluble carbohydrates of this kind in the form of paps, sops and milk puddings. He should be able to take part of his fat in the form

of butter, dripping, bone-marrow, etc., spread on bread or toast. He should also be taught to digest soft vegetables such as vegetable marrow, Jerusalem artichokes, Brussel sprouts, tomatoes, well-boiled carrots, etc., while a small quantity of meat or fish should not be beyond his capacities.

His meals should be three in number: breakfast, dinner, and tea, with possibly a fourth the first thing in the morning or the last thing at night, but if so it is better only to give orange-juice with a little sugar and water in the morning, or a little soup or calf's-foot jelly at night.

The total quantity for the 24 hours should be between 950 and 1,000 Calories. Of these 400 will be afforded by 1 pint of milk, and the remainder must be supplied in the form of bread, toast, rusks, egg, vegetables, butter, stewed fruit, and possibly a little meat or fish. The total day's ration should be divided up into the three meals, giving about 300 Calories at each meal.

Breakfast should consist of about 8 oz. of milk (160 Calories) flavoured, if thought desirable, with a little cocoa, chocolate, Ovaltine, or sugar. This should be supplemented with a little bread and butter, say 1–1½ oz. (100 Calories). Wholemeal or brown bread has the advantage over white highly refined bread from the point of view of the water-soluble vitamin B factor, and also from the point of view of its mineral content. Further, a small quantity of fruit jelly, stewed fruit, or jam without seeds or pips may be given spread on bread, or eaten separately.

I do not regard it as a good plan to give fish, meat, or egg at this meal, although these may be allowed if the child prefers his proteins in this form and dislikes milk. The danger is in over-doing the proteins. I am no believer in porridge, Quaker Oats, rice, or other variety of patent or sloppy food, provided the child will take his carbohydrate food in the form of bread, toast, or rusk. The old superstition that there is some special virtue in porridge dies hard. The belief that oats and oatmeal are superior as foods to wheaten flour is based on no scientific grounds, and even if they did possess some magic charm there can be no virtue in soft pappy porridge over oatmeal biscuits or oat cakes which require mastication. Some children, however, like porridge, and if so, their fancy may be humoured, always remembering that at the earliest opportunity this slop should be replaced by some solid form of carbohydrate which demands mastication. It is a good plan to add Bemax, which contains a good representation of vitamin B_1, to any cereal taken at breakfast. Bread fried in bacon fat may be substituted for bread and butter, but pig fat or lard is not such a good fat as butter. Stewed fruits, such

TABLE X

Sample Diet Sheet for a Child 1 Year Old

6 a.m.	Breakfast, 8.30 a.m.	Dinner, 12.30 p.m.	Tea, 5 p.m.	Supper, 7 p.m.
Orange-juice ½ oz. Sugar . . ¼ oz. Water . . 2 oz.	Milk . . . . 8 oz. Sugar . . . . ¼ oz. Cocoa . . . . ⅙ oz. Bread . . } singly or Toast . . } combined Rusk . . } 1–1½ oz. Butter . . Dripping . . } singly or Bacon fat } combined. or Margarine . Jam (without seeds, pips or skins). Jelly, baked apple or fresh fruit.	Whiting (stewed in milk) 1–1½ oz. or Egg . . . . 1 oz. Brussel sprouts (mashed) 1 oz. or other green vegetables. Potatoes . . . 1 oz. Bread . . . . 1 oz. Semolina pudding 1–2 oz. Stewed fruits without seeds, pips or skins.	Milk . . . . 8 oz. Sugar . . . . ¼ oz. Ovaltine . . . ¼ oz. Bread . . } singly or Toast . . } combined Rusks . . } 1–1½ oz. Plain cake } Oatmeal biscuits } Butter . . . } ¼ oz. Dripping or margarine . . . } Jam (without seeds, pips or skins). Jelly, ¼ to ½ oz. *or* marmite.	Broth . . 3 oz. Jelly . . . 1 oz. or Benger's food 2 oz.
30 Calories.	300 Calories approximate.	357–527 Calories approximate.	300 Calories approximate.	10–50 Calories approximate.

Total Calories 997–1,227 approximate.

as prunes or apples, may be given in place of jam or jelly, the juice being particularly valuable from the point of view of its salt content. As a condiment, and as a means of supplying the water-soluble "B_2" factor, a little Marmite spread on bread or toast is useful at times.

Dinner. Arrangements for this meal must in the case of poor households be subordinated to the prevailing economic and domestic conditions and its character must be made dependent on the requirements of the rest of the family.

In the first place it should contain some good representative of the class of protein foods, such as egg, fish, or meat. A little meat from a good beaf-steak pudding with plenty of gravy fulfils the requirements excellently, and a little of the crust will do no harm. The total quantity of meat, fish, or egg should not exceed 1 oz. at first, at least not until the child is some 18 months or so old. The meat may have to be well minced up, or the fish pounded, but if the child can masticate properly, this precaution becomes unnecessary and undesirable.

As for vegetables, these are most essential. Potatoes are perhaps the least valuable as they consist mainly of starch, but they may be given in small amount. Turnips (mashed), vegetable marrow, Brussel sprouts, onions (boiled), tomatoes, and fine cabbage, are all excellent. Carrots, parsnips, peas, beans, etc., and other hard vegetables must be mashed or sieved. As a change a cup of vegetable and meat broth is useful, and to this may be added bread sop, vermicelli, spaghetti, or other Italian paste preparations. The first course may be followed by milk pudding, custard pudding, or suet pudding, always with stewed fruit with plenty of juice. Currants and raisins should be avoided unless minced very finely, since the skins are absolutely indigestible and are apt to cause colicky pains. Treacle, though a good condiment, is merely a bad sugar, and contains no mineral elements or vitamins whatsoever.

Tea should be planned on the same lines as breakfast, and should consist of about 8 oz. of milk, bread and butter, jam, stewed fruit, and biscuits or plain cake. Children over 18 months of age may be allowed a little fresh lettuce, mustard and cress, tomatoes, or watercress, as a means of affording a supply of the water-soluble anti-scorbutic vitamin. Radishes, raw onions, cucumbers, etc., are not recommended for children under 5 years of age.

Sample Diet Sheet for a Child 5 Years of Age.

The diet should be gradually expanded as the child advances from 1 to 5 years of age, the chief advance being made in con-

nection with the introduction of larger quantities of meat, and fish, and the provision of vegetables of a harder and more indigestible character. Green food, too, such as lettuce, watercress, or mustard and cress, may be taken with tea or breakfast, and raw fruits of various kinds may be consumed with safety even between meals. The total quantity of food must also be increased; at 5 years the caloric requirements are about 1,600 for the 24 hours, if the child is vigorous and active. Feeble or delicate children require a smaller amount. The question of supper is a difficult one. The child should not go to bed with a full stomach, but, on the other hand, some do not sleep if they feel hungry. Bread or biscuits eaten the last thing at night are a source of danger to the teeth, for particles of starch adhering to them or becoming wedged between them undergo fermentation during the night with the production of acetic and other acid bodies, which are not neutralized by saliva, since there is little secreted during sleeping hours. All acids remaining in contact with the teeth tend to erode and decalcify the enamel and dentine, and thus predispose to caries. Milk is rather a heavy food to take before going to bed. Soups or broths are the best foods to take the last thing at night. A small quantity of water may be taken between meals to bring the total amount of fluid up to about 50 oz. in the 24 hours.

Simplified Diet Sheet for a Child 5 Years of Age

On waking—about 7 a.m. Juice of orange, with one Nutritive Triturette (page 696).

Breakfast:

8 oz. milk flavoured with cocoa, Ovaltine, or a very little tea or coffee.

Cereal, such as Shredded Wheat, Cream of Barley, or Cream of Wheat, with a teaspoonful of Bemax.

Wholemeal bread toasted, butter, jelly, or seedless jam.

Alternatively, stewed prunes, apricots, or baked apple.

Occasional green food, such as lettuce or watercress.

Dinner:

Meat twice a week.

Eggs twice a week.

Fish twice a week.

Occasional liver, brains, tripe, sweetbread, etc. Plenty of vegetables, preferably steamed. Potato limited.

Milk or steamed puddings with stewed fruit.

TABLE XI

Sample Diet Sheet for a Child 5 Years of Age

On Waking.	Breakfast, 8–8.30 a.m.	Dinner, 12.30 p.m.	Tea, 5 p.m.	Supper, 7 p.m.
Juice of an orange with sugar and water.	Milk . . . 8 oz. Sugar . . . ½ oz. Cocoa . . . ¼ oz. Bread or toast 1½–2½ oz. Butter . . . } ¼ oz. Margarine or dripping } Stewed fruit, baked apple *or* raw fruit (orange, grape, banana) or lettuce.	Beef-steak pudding with plenty of gravy 2 oz. Potato . . . . 1 oz. Cabbage 1 oz. (or other green vegetables). Milk pudding . . 2 oz. Stewed fruit . . 1 oz. Bread . . . . 2 oz. Water (?) . . . 6 oz.	Milk . . . . 8 oz. Sugar . . . ¼ oz. Cocoa, Ovaltine, or chocolate . } ¼ oz. Bread . . . . } 3 oz. Toast . . . . Plain cake . . . Oatmeal biscuits Shortbread . . Butter . . . } ¼ oz. Margarine or dripping } Jam or stewed fruit *or* lettuce or watercress *or* marmite.	Vegetable broth 4 oz. Bread . . . 1 oz. *or* Rice pudding (cold) 3 oz.
60 Calories.	450 Calories approximate.	350–500 Calories approximate.	500 Calories approximate.	150 Calories approximate.

Total Calories for 24 hours = 1,660.

Tea :

8 oz. milk, flavoured as for breakfast. Plain cakes or biscuits —toast, butter and jam.

Before going to bed a cup of soup without any additions, or a little calf's-foot jelly, may be given.

CHAPTER V

NUTRITIONAL DISEASES DUE TO DIETETIC FAULTS AND DEFICIENCIES

The arrangement and grouping of the diseases included in this section are not based on any scientific plan which has reference to their etiology or pathology, but on commonsense principles and considerations. So long as those who refer to this book for assistance in treating particular diseases can find the number of the page on which the disease is described by reference to the index, it matters very little in what section of the book they find the information they require, or under what group of diseases it is classified.

The classification of disorders of nutrition is particularly difficult on any systematic principle, for malnutrition can result from a number of different causes—as for instance, from bad feeding, faulty digestion, failure of absorption, disturbances of metabolism or excretion, or from infection.

In this chapter will be discussed those diseases of nutrition which are primarily and definitely due to some defect in the dietary. Most of the diseases which commonly come within this category are now styled "deficiency diseases," because they are believed to be due to the deprivation of some essential element. As there are many other elements besides vitamins which are essential for nutrition, and in the absence of which symptoms occur, it seems a great pity to restrict the term "deficiency disease" to those due to deprivation of any one exclusive class of essential food element, such as the vitamins. Deficiencies with respect to iodine, iron, calcium, phosphorus, and even sodium chloride, all produce definite trains of symptoms which have just as much right to be regarded as pathological entities or symptom complexes as any of the more generally recognized avitaminoses.

Certain diseases which are sometimes classified as disorders of nutrition, such as marasmus, and cœliac disease, are not included in this chapter, although even these may be primarily due to

errors of diet, for the reason that I do not personally regard either of them in their fully established forms as belonging properly to the category of dietetic diseases. The term " Marasmus " is loosely employed to cover a number of quite independent disorders, some of which are due to disturbances of digestion, while others may be associated with intestinal toxæmias : cœliac disease though greatly aggravated by the dietetic régime to which it is commonly subjected by way of treatment, is probably mainly dependent on some fault of absorption, and is better included in the chapter which is concerned with diseases of the alimentary tract.

We very rarely meet with what one may call a clean-cut or classical example of a deficiency disease, that is to say one which is due to deprivation of only one essential element in the dietary. When there is one defect in a dietary it is almost sure to be accompanied by other deficiencies or excesses, and in this connection it must be remembered that there may be quite as many diseases and symptom complexes due to excesses, as there are to deficiencies. Rickets, for example, as generally described, appears to be not only a mêlée of heterogeneous symptoms due to deficiencies as well as to excesses of various food elements, but also one of other hygienic defects. It is certainly not a clear-cut pathological entity due exclusively to a deficiency of vitamin D. What is true of rickets, is also more or less true of all the other deficiency diseases which have been honoured with a special title ; they very seldom present themselves in the pure form, but are nearly always composite diseases due to many and varied etiological factors.

Vitamin A Deficiency

Until recently it has been the general view that one of the chief functions of vitamin A is to promote growth. Indeed, the term growth-factor which has been applied to it is likely to lend colour to this view, and perpetuate the belief which is possibly not more accurate than that this vitamin has the further property of raising resistance to infection. It is now more generally believed that vitamin A deficiency results primarily in the precocious keratinization of the epithelium of mucous and skin surfaces, especially those of the cornea, and of the respiratory, alimentary, and genito-urinary tracts, and of the ducts of such glands as the parocular and pancreatic, and by so doing gives rise to secondary pathological results such as bacterial infection, catarrhs of the respiratory tract, enteritis, pyelitis, anæmia, and

cessation of growth. If this latter view is correct, it is hardly logical to expect that the administration of therapeutic doses of this vitamin will have much influence in curing established infections, such as those due to septic, pneumococcic or coli organisms, however valuable such a measure may be in preventing the breaking down of the natural barriers to bacterial invasion which intact epithelial surfaces afford. Further, since there are many other etiological factors concerned in such conditions it must not be assumed that their development will be avoided by the precautionary measure of giving adequate supplies of vitamin A. Pathological sequences are certain to ensue if vitamin A is not given in sufficient amount, but adequate dosage of this vitamin is no guarantee against loss of weight, infection, or any of the other symptoms usually included in the vitamin A deficiency syndrome.

Another belief commonly held in connection with vitamin A, which must be received with caution, is that it is identical or isomeric with carotene—a lipochrome substance existing in considerable amount in the yellow petals of flowers, in carrots, and other vegetables. Carotene has the same properties as vitamin A when administered orally to human beings and animals, but it is not identical with it, although it appears to be a fore-stage of it, and capable of losing its yellow colour and of being converted into a colourless form by the activity of the liver cells, where it may be stored in considerable amount, and whence in the case of animals, it may be extracted in high degrees of concentration. Since carotene is itself a pure crystalline substance with apparently the same properties as vitamin A, it has been chosen as a suitable substance for the provisional standardizing of the potency of vitamin A preparations. The unit of potency of vitamin A preparations is the equivalent of the potency of 0·001 mg. of purified crystalline carotene.

The Dosage. The dosage of vitamin A has been placed on a more accurate basis since its standardization in terms of international units, and since relatively pure concentrates of this vitamin unmixed with vitamin D, have become available. Until these were procurable, it was only possible to prescribe vitamin A in such natural products as cod-liver oil, or halibut-liver oil, in which vitamin D was also present in such large quantities as to preclude the giving of massive doses of vitamin A without incurring the risk of producing over-calcification.

Prophylactic Dosage. It has been estimated that the prophylactic requirement of infants with respect to vitamin A is 300 units for every 100 Calories of food consumed. Calculated on

this basis the daily requirement of vitamin A for infants of different ages is as follows :

At 3 months	1,500 units
„ 6 „	2,250 „
„ 1 year	3,000 „

Few infants who are exclusively breast fed obtain a sufficient number of units of vitamin A without supplementation. Admitting that the potency of breast milk differs with respect of vitamin A with its source and with the nature of the food consumed by the woman who supplies it, it may be assumed that on an average breast milk contains about 60 units per oz. The requirements therefore of infants of 3, 6, and 12 months, would be satisfied by 24, 36, and 48 oz. of breast milk respectively. In other words, infants of different ages, receiving normal quantities of such milk, barely have their requirements for vitamin A satisfied, even though the milk has a normal vitamin A content. The margin of safety is so small that it is probably a wise precaution in all cases to supply infants with a supplementary ration of vitamin A, independently by means of the ordinary administration of vitamin A concentrates, or indirectly through the milk of the mother by giving her similar preparations.

In giving supplementary doses of vitamin A directly to the baby, or indirectly through the mother, it is usual to give more than the bare minimum requirement. About 5,000 units daily is not considered excessive for a baby 6 months of age. This number of units would be afforded by 2½ drachms of cod-liver oil, 5 drops of halibut-liver oil, or by 2–3 drops of Avoleum (British Drug Houses), or a similar dose of Essogen (Lever Biological Laboratories). These doses are calculated on the basis of the following degrees of potency with respect to these preparations :

30 minims (½ drachm)	cod-liver oil contains	1,000	units.
1 minim	halibut-liver oil . .	„ 1,000	„
0·5 „	Avoleum . . .	„ 1,000	„
0·3 „	Essogen . . .	„ 1,000	„

Therapeutic Dosage. Massive doses of vitamin A are usually given in cases of xerophthalmia, enteritis, respiratory catarrhs, infections, etc., which are believed to be due to vitamin A deficiency, and keratinization of mucous epithelium. By massive doses is meant doses of from 30,000 to 40,000 units daily. This treatment must be continued for some time after the symptoms have disappeared ; moreover, it should be pursued even if the symptoms do not at first appear to improve. With these massive doses it is probably unwise, lest hyper-calcification should occur, to give combined concentrates of vitamins A and D. It is wiser

to give the vitamin in the purest possible form, either as Avoleum (B.D.H.) or Essogen (Lever Biological Laboratories); 15–20 minims of these preparations should constitute a sufficient daily dosage for an infant 6 months of age, since 1 drachm of either contains about 120,000 units.

Vitamin B Deficiency

The whole subject of vitamin B deficiency symptoms is complicated by the fact that vitamin B is not a single entity as was formerly supposed, but a complex consisting of several different fractions, each possessing slightly different properties. These component factors have been provisionally designated B_1, B_2, B_3, B_4, etc., but as yet we do not know how far this series extends and none of the individual factors in the group have been isolated in a pure form except the B_1 factor, which has been prepared in crystalline form from rice-bran, and yeast. It is apparently a pure sulphur-containing amine, of the empirical formula C_{12} H_{16} N_4 OS. The anti-neuritic and beri-beri preventing properties of the vitamin B complex are said to be attached exclusively to the B_1 fraction, while the pellagra preventing properties are associated with the B_2 fraction—the so-called PP factor. The properties of the remaining factors of the group are more obscure, but they appear to be connected with growth, but the whole story of the vitamin B complex has not so far been unravelled. We know however that different concentrates and different natural sources of this vitamin contain different proportions of the component elements, and hence have distinctive values, both in the treatment and in the prevention of the various pathological conditions which are attributed to deficiencies of the whole complex, or any of its parts.

Up to date the potency of the various factors in this complex has not been standardized, with the exception of the two principal components, B_1 and B_2. B_1 is estimated in terms of the so-called international units, and B_2 in terms of the Bourquin-Sherman Units.

By reason of this standardization, the dosage of vitamin B_1, and to a certain extent the dosage of the whole vitamin complex, has been rendered fairly accurate. It has been estimated for instance that the minimum requirement of infants and children for B_1 is represented by 30 international units for every 100 Calories of food consumed, and if a concentrate of the whole vitamin contains a suffiency of the factor B_1, it may be assumed that it will also contain about the correct dosage of all the other fractions.

In accordance with this estimation, an infant 3 months old,

requiring an allowance of 500 Calories, would need 150 international units of B_1, and at 1 year and 5 years respectively, it would require 300 and 450 international units.

If infants and children do not obtain this number of units in their food, they are liable to develop certain symptoms characteristic of this particular deficiency. In this country they do not develop the fully declared symptoms of beri-beri or pellagra, but they are subject to certain larval symptoms which take the form of delayed growth, imperfect nutrition, and incomplete development, especially as regards that of the digestive organs and the alimentary tract as a whole.

A great variety of miscellaneous symptoms have been attributed by different observers to vitamin B deficiency, such as loss of appetite, indigestion, intestinal stasis, intestinal toxæmia, colitis, constipation, macrocytic and other forms of anæmia, œdema, and various nervous and skin lesions. To deprivation of which particular factor in the vitamin B complex each of these symptoms is to be attributed is unknown, but many of them certainly seem to improve with the therapeutic administration of full doses of the whole vitamin, and what is perhaps more important in both infants and young children, by its prophylactic administration in adequate doses these symptoms are less likely to develop.

The question naturally arises, do infants who are breast or bottle fed, as well as children of an older age, obtain enough of this vitamin complex in their ordinary dietaries to be able to dispense with any supplementary additions. The vitamin content of both human and cow's milk has been variously estimated, but the following figures may be regarded as approximately correct for average samples.

Human milk contains 5 International Units per oz.
Cow's milk contains 6·2 International Units per oz.

Hence, an infant 3 months of age, and consuming 25 oz. of breast milk, will receive 125 International Units. This shows a definite deficiency of about 25 International Units, as compared with the estimated requirements. In the case of an artificially fed infant, the discrepancy will be still greater, since cow's milk which in some form will probably constitute the substitute dietary will almost certainly be diluted, and the same will be true of infants of all ages who subsist exclusively on a milk dietary: there will always be an appreciable deficiency.

The vitamin B intake of children who are on a mixed dietary is more difficult to assess, but on the whole it is less likely to err on the side of deficiency if their food contains a good representa-

tion of any of the following articles of diet: whole-meal bread, leguminous or green vegetables, egg yolk, and meat, all of which contain a good amount of this vitamin. All the same, since there is no reason to believe that any ill results are likely to accrue owing to vitamin B excess, it is advisable to be on the safe side and give all growing children supplementary supplies of vitamin B in the form of Bemax, Marmite, yeast preparations, or malt extract.

In the following list the approximate content of vitamin B_1 is given for some of the better known of these preparations.

Egg yolk	contains	40–50	International	Units	per	oz.
[1] Marmite	,,	258–268	,,	,,	,,	,,
Bemax	,,	400	,,	,,	,,	,,
Yestamin (Yeast preparation)	,,	700	,,	,,	,,	,,
Allenbury's Dried Yeast	,,	1,100	,,	,,	,,	,,
Phillip's Live Yeast	,,	1,297	,,	,,	,,	,,

The quantity of any of these preparations, or any combination of them, which should be given for prophylactic purposes to infants and children in addition to that which is already contained in their ordinary dietary, should be so adjusted as to provide at least 100 International Units for infants under 1 year, and from 100 to 200 International Units for children between 1 and 5 years of age. Much larger doses, up to 700 International Units or more, must be given for curative purposes, and the same larger doses must be given to nursing mothers if it is desired to increase the vitamin content of their milk.

Pink Disease

(Erythœdema Polyneuritica; Feer's Disease; Trophodermatoneurosis; Swift-Feer Disease; Swift's Disease; Acrodynia)

This disease has received a great number of different names, as the list above indicates—that is to say, it has been constantly rediscovered as a new disease. The diagnosis should not prove difficult however, as the signs and symptoms are quite characteristic, but as a matter of fact a large number of cases escape recognition until they are brought to hospital.

The chief features are:

1. A pink coloration of the extremities, hands, feet, nose, cheeks, etc.

[1] Much higher figures up to something like 700 International Units per ounce, are claimed for this preparation by the manufacturers. The above figures, however, represent the average of independent analyses, carried out probably by a different system to that employed by the manufacturers of Marmite. Marmite appears to be particularly rich in the B_2 factor.

2. Atony of muscles.
3. The position occupied by the child as he lies in bed is such that he is coiled up with the face buried in the pillow and the head between the feet in the so-called "penknife position" [see frontispiece].

The child is the picture of misery, and suffers from insomnia, anorexia, and photophobia. The hair tends to fall out, and the teeth to be shed, while the skin of the hands and feet desquamate. The latter are cold and damp, as well as pink. By reason of these and many other symptoms which may be explained on the ground that the disease is a "vegetative neurosis," Pink disease should be recognized readily enough, but as a matter of fact it is often mistaken for other diseases, such as alopecia areata, eczema, encephalitis, erythema, chronic intestinal indigestion, pellagra, ring-worm, scabies, scarlet fever and scurvy. Owing to the fact that the teeth sometimes drop out, it has within my own experience been mistaken for alveolar pyorrhœa.

The cause is unknown, but it frequently follows some infection, such as diphtheria, or influenza. It is probably not the same disease as epidemic acrodynia, which attacks adults, and with which it was formerly supposed to be related. Cases for the most part occur sporadically, but within my own knowledge there seems to be a predisposition for certain localities. This may mean however that in these places the disease is recognised. The great resemblance to pellagra and to a lesser extent to beri-beri, is very suggestive of a similar etiology, that is to say, it may be a form of deficiency disease, although in all respects it does not conform to the usual definition of an avitaminosis.

The disease runs a very chronic course, and responds only very slowly to treatment.

Treatment.

Prophylactic. As the cause of the disease is still a matter of surmise, it is impossible to make definite suggestions for its prevention, but all the same, I believe that it is a nutritional disorder, and can be prevented if all the canons of correct physiological feeding are complied with, especially as regards the supply of the accessory factors, the vitamins, and mineral elements. In my opinion, the factor in the diet of infants and children which is most generally at fault, is the vitamin B complex, so that whether or not a deficiency of this vitamin is concerned in the etiology of Pink disease, great care should be taken to see that adequate quantities of this vitamin are supplied in the diet. This can be secured by the routine administration of Bemax, or yeast preparations to all infants and young children. I have for many

years past been in the habit of prescribing for all babies vitamin B, in one of these forms, and in comparatively large doses. During the whole of that time I have never noticed in these infants as they grow older any of the many symptoms which make up a typical case of Pink disease.

Curative. These cases tax the patience of the nurse to a very high degree. The anorexia, sleeplessness and irritability, as well as the utter misery of the child, call for very special resourcefulness and nursing. The photophobia must be humoured, and I believe that as in the case of pellagra, this disease is one of the very few which does not benefit from helio-therapy, although this measure is often prescribed. Although fresh air and good ventilation are a necessity, the child should be kept confined to bed, and not too warmly clothed, as sweating is one of the most insistent of the symptoms. The sleeping garments may be of Aertex or some similar cellular material. " Airlin " and " Meshlin " materials are very suitable for this purpose.[1] Braemar wool cellular materials,[2] are also useful.

The sleeplessness must be very carefully handled, owing to the chronic character of the disease, and the danger of the acquisition of a drug habit, if powerful soporifics are resorted to. In spite of its reputed depressing properties I believe that bromide of ammonium is the least harmful drug that can be employed to promote sleep, and should be given in full therapeutic doses.

For the anorexia hydrochloric acid, nux vomica, and gentian are indicated. Vitamin B is also valuable for the same purpose.

For the irritation of the skin and the perspiration, a good talc powder should be dredgered freely over the hands, feet, and body, or indeed wherever there is any rash or irritation.

Drugs. It is usually stated that there is no specific treatment for this disease, as its cause is not known. For my part I believe that vitamin B complex is, in a sense, a specific, though slow in action. I have been in the habit of giving really large doses, for instance, 4 or 5 tablets of Yestamin three times a day, or 1 oz. Bemax in divided portions during the 24 hours. Small doses appear to me to be useless.

On theoretical grounds, owing to its similarities with pellagra and beri-beri, I should expect in Pink disease that the B_2 factor would have a more specific action than the B_1 factor, and for this reason Marmite would be more valuable than Bemax, owing to its larger relative proportion of the factor B_2 in it. In actual

[1] Manufactured by the Irish Linen Manufacturing Company, Belfast.
[2] Sold by Messrs. Boulders of 64, Oxford Street, W.1.

practice however I have not found this to be the case, and I think that the whole vitamin B complex is better than any of its component factors given independently.

Another preparation I have found to be of use is Etan, which is a polyvalent amido-acid extract. This may be given to the extent of 1 teaspoonful three times a day. Most authorities are agreed that raw liver, or liver in some form is indicated. As it is very difficult to get a child suffering from anorexia to take a sufficient quantity of liver in the raw form, it is better to give it in one or other of the many agreeable forms which are now available, such as Hepol Elixir (A. & H.) which may be given to the extent of 1 tablespoonful daily, or Campalon (Bayer), a liver extract specially prepared in ampules for intramuscular injection, which may be administered by this route in doses of $\frac{1}{2}$ c.c. daily, or 3 c.c. once weekly.

Infantile Scurvy

(Vitamin C Deficiency)

The diagnosis and the treatment of infantile scurvy has been greatly simplified by the discovery of the affinity, if not the identity, of vitamin C with ascorbic acid, an organic acid of definite constitution, and capable of synthetic manufacture, as well as of easy quantitative estimation.

Infantile scurvy is a somewhat peculiar disease in that it takes a considerable time for the recognizable symptoms to develop under the influence of vitamin C deprivation, but when they do display themselves there is no mistaking them owing to their dramatic and fulminating character. This does not imply however that there are no fore-stages of scurvy which are pathological in character and detrimental to health. The symptoms however of sub-scorbutic conditions are very difficult to recognize by ordinary clinical means, for they appear to be merged in those of general malnutrition. The prodromal symptoms of scurvy, like those of the other deficiency diseases, require study and definition, so that they may be recognized and treated before they gather force and assume formidable proportions.

Mainly owing to the investigations of Dr. L. S. Harris, we are now able to recognize vitamin C deficiency in suspected cases by urinary analyses. It appears that infants must be supplied with a definite quantity of vitamin C if the development of scorbutic or sub-scorbutic states is to be avoided, and that under normal conditions a certain proportion of this necessary intake is excreted in the urine. When however the system becomes depleted of this essential acid and a sub-scorbutic condition is established,

or is threatening, analysis of the urine discloses an absence of ascorbic acid, and this absence prevails for a time, in spite of oral administration of considerable quantities of the vitamin, until in fact the depleted tissues become again saturated.

The test for ascorbic acid in the urine consists in titrating the urine immediately after it has been passed, or after taking due precautions for its preservation, against a recently standardized solution of 2·6 dichlorophenolindo-phenol, and estimating the amount of urine which is needed to discharge the colour completely. As the technique offers opportunities for error, it is advisable that the estimation should be carried out with due precautions by some one familiar with the method.

As regards the quantity of ascorbic acid which it is necessary to administer orally to prevent the development of scorbutic or sub-scorbutic conditions, it is a little difficult at the present time to speak with certainty, but it may be assumed since scurvy practically never develops in breast-fed infants, that human milk contains an adequate amount of the vitamin to protect against this deficiency disease, provided that the total amount of milk taken in the 24 hours is normal and adequate. Since the average amount of ascorbic acid in breast milk is 0·056 mg. per c.c. and the average amount of breast milk consumed by infants between 3 and 12 months of age in the 24 hours is 500–1,000 c.c., the total amount of ascorbic acid consumed will be between 28 and 56 mg. in the 24 hours. Such quantities are practically never provided when infants are fed on artificial substitutes for breast milk. Cow's milk straight from the udder only contains on an average 0·02 mg. per c.c., that is to say, less than half that of breast milk, but infants are seldom or never fed on perfectly fresh cow's milk, it is generally stale and usually cooked; moreover, it is almost invariably diluted. Artificially fed infants should therefore receive nearly the full prophylactic dose of ascorbic acid in the 24 hours, apart from that afforded by their milk dilutions.

To check the adequacy of the vitamin dosage, the urine may be tested to judge how far the ascorbic acid output falls within the limits of normality, namely, 0·01–0·02 mg. per c.c. of urine; or assuming that the infant passes about 568 c.c. of urine in the 24 hours, within the limits of a total output of 5·6 to 11·2 mg. daily.

Treatment. The treatment of definite and uncomplicated cases of scurvy, as also of sub-scorbutic conditions, is very simple. The general management of the case must be conducted in accordance with ordinary hygienic principles, with particular care in the case of sub-periosteal hæmorrhages, to see that the

utmost gentleness is used in washing, changing, or handling the infant.

The specific treatment consists in giving the infant from 50 to 200 mg. of ascorbic acid daily until a cure has been effected. This can be done by administering from 3 to 12 oz. (100–400 c.c.) of orange-juice in the 24 hours, since 1 c.c. of orange-juice contains about 0·68 mg. of ascorbic acid. When dealing with such large doses however it is better and simpler to give the vitamin in pure or concentrated form, and for this purpose there is no better preparation than that of Redoxon (Hoffman La Roche), which is made up in tablets, each of which contains 50 mg. of ascorbic acid. When using this preparation, it will therefore be necessary to give from 1 to 4 tablets in the 24 hours. In those cases in which progress can be watched by examination of the urine for ascorbic acid, this treatment must be continued until the output of ascorbic acid in the urine reaches from 0·01 to 0·02 mg. per c.c. of urine. Since such scientific control however is not usually available, the large dosage must be continued until symptoms of tenderness and sponginess of the gums has disappeared. From that time onward a prophylactic dose of 5·6–11·32 mg. of ascorbic acid will probably be sufficient to prevent any further recrudescence of scorbutic symptoms. This quantity will be afforded by 3–6 drachms of orange-juice daily.

Rickets

(Vitamin D Deficiency)

Although rickets is now almost universally regarded as one of the deficiency diseases, and specifically due to deprivation of vitamin D, it must be abundantly clear to any careful observer that all the symptoms which are commonly included under this title, such as stunted growth, sweating, anæmia, liability to catarrhs, and a whole host of others, cannot be due to so exclusive a cause as want of a single vitamin, nor capable of being cured by so simple an expedient as the therapeutic administration of a little cod-liver oil.

The truth of the matter is that the disease commonly called rickets is really a composite one, although its central and highly characteristic feature is a specific defect in osteogenesis, which may be easily recognized during life by means of an X-ray examination of the bones. This composite disease cannot be cured in its entirety by giving a few units of vitamin D, although the bony defects themselves may definitely yield to this treatment. The non-specific symptoms, the anæmia, catarrhs, stunted growth, muscular flabbiness, the laxity of ligaments, the sweating and

nervous irritability, must all be treated on appropriate lines in accordance with their specific origin and pathogenesis. This means that the successful treatment of an ordinary case of rickets demands a very careful consideration of all possible defects in the environment, and must include a thorough revision of the dietetic and general hygienic management.

Although in the following account of the treatment chief attention will be paid to the cure of the specific bony defects, the general management of the case demands resort to some or all of the following measures :

1. The diet should be carefully reviewed to see that it fails in no respect to fulfil the requirements of physiological feeding, and in particular that it contains an adequate amount of all the vitamins, not vitamin D only, and all the mineral elements, including particularly calcium and phosphorus.
2. Massage and passive exercises should be given to infants not yet able to walk, while active exercise in the open-air should be encouraged in the case of those who have reached the walking stage.
3. Fresh air and sunshine are important factors from the point of view of reaching or maintaining a high standard of general nutrition, and stimulating general metabolism.
4. All concomitant symptoms, such as those already referred to and generally included in the rachitic syndrome, must each receive their appropriate treatment.

Owing to the high probability, nay, almost certainty, that some degree of acidosis complicates the condition, full doses of bicarbonate of soda and other alkalies should be a part of the routine treatment.

Since many cases are wrongly diagnosed as rickets, especially in the case of children with exaggerated tibial curves, bossed foreheads, pigeon chests, and other congenital deformities of the skeletal system, it is in my opinion very desirable that whenever possible the diagnosis of rickets should be confirmed or refuted by an X-ray examination of the long bones before specific treatment of rickets is attempted, and further, I think it very desirable that the results of specific therapy in such cases as those in which it is properly indicated, should be checked from time to time by the evidence of further X-ray observations.

Specific Treatment of Rickets. There are three ways in which compensation can be made for a deficient supply of vitamin D.

(i) By providing natural foods which contain a good representation of vitamin D.

(ii) By giving vitamin D in some medicinal form.

(iii) By the exposure of the body to Ultra Violet radiation, either natural or artificial.

Both the prophylactic and curative treatment of rickets have reached stages of precision, because it is now possible to express the therapeutic value of the various preparations containing vitamin D in terms of units, namely, the so-called International Units. One such unit is defined as the amount of vitamin D that possesses the anti-rachitic activity of 0·001 gm. of the standard preparation of irradiated ergosterol. Gauged by this standard, 1 c.c. of an ordinary good sample of cod-liver oil provides 100 units; 1 c.c. of Ostelin provides 5,000 units; 1 c.c. of Radiostol provides 3,000 units; and Calciferol, a pure crystalline form of irradiated ergosterol, provides 40,000 units per milligram.

As for dosage, Dr. L. J. Harris, has suggested that 1,500 International Units a day may be regarded as an average prophylactic dose for a child of 2 years old, and that for infants under 1 year of age the dose might commence at 250 units at birth, and gradually work up to the above full 1,500 dose, at 1 year of age.

The curative dose may be taken at about three times that of the prophylactic dose. Dr. Harris considers that 10,000 units may be regarded as the maximum dose under any conditions, and on the border-line of danger and likely to produce symptoms of hyper-vitaminosis, which consist for the most part of calcareous deposits in the kidneys, raised blood calcium, and excessive excretion of calcium in the urine if long confirmed.

The Supply of Vitamin D in Food. The natural sources of vitamin D, are butter-fat, cream, milk, liver, kidneys, yolk of egg, and of course cod-liver oil and the liver oil of other fish, and especially that of the halibut. It is very doubtful whether under normal conditions of feeding, and without special precautions, infants are likely to consume a sufficiency of this important vitamin in their ordinary dietary to serve as a reliable prophylactic against the incidence of rickets. Moreover, a great seasonal difference occurs in the vitamin content of these natural foods, and especially in the case of milk. Cow's milk and all its products have their lowest vitamin content in this country during the first 3 months of the year, and their highest in late summer and early autumn, corresponding with the amount of available sunshine and the vitamin content of the food consumed by the animals which produce the milk. Various attempts have been made to improve the quality of milk by direct irradiation, or indirectly by feeding the milking cows on irradiated yeast, but there are practical

difficulties connected with the use of the milks of cows treated in these ways, because of the variability of their vitamin content, under different methods of treatment and feeding.

The Supply of Vitamin D in Medicinal Preparations. A complete revolution in vitamin therapy was inaugurated by the discovery that vitamin D could be prepared synthetically, and dispensed in accurate dosage in terms of International Units. Although cod-liver oil and halibut-liver oil contain a rich representation of this vitamin, the degree of concentration differs so materially with the source of supply that no dependence can be imposed on the accuracy of the dosage. Moreover, both these oils contain vitamin A as well as vitamin D, which complicates their use. A further argument against their administration, especially for young infants, is that these oils are not always well tolerated in the quantities which are necessary to provide the required number of units. If a combination of these vitamins is indicated, it is probably better to use some standard preparation, in which the efficiency of both is expressed in terms of units.

MEDICINAL PREPARATIONS CONTAINING VITAMIN D

Radiostol (British Drug Houses).
Contains 3,000 International Units per c.c.
Dose to provide 1,500 units about 8 minims (0·5 c.c.).
Average prophylactic dose 5–15 minims daily.
Average curative dose 15–45 minims daily.

Ostelin (liquid) (Glaxo laboratories).
Contains 5,000 International Units per c.c.
Dose to provide 1,500 units about 5 minims.
Average prophylactic dose 2–10 minims daily.
Average curative dose 6–30 minims daily.

Viosterol (Allen & Hanbury).
Contains 10,000 International Units per c.c.
Dose to provide 1,500 units about 3 minims.
Average prophylactic dose 1–3 minims daily.
Average curative dose 3–9 minims daily.

Organon (Crookes, Vitamin D).
Contains 10,000 International Units per c.c.
Dose to provide 1,500 units about 3 minims.
Average prophylactic dose 1–3 minims daily.
Average curative dose 3–9 minims daily.

MEDICINAL PREPARATIONS CONTAINING BOTH VITAMIN A AND VITAMIN D

Radiostoleum (liquid) (British Drug Houses).
Contains 15,000 vitamin A International Units per gm.
(500 blue (Carr-Price value))
3,000 vitamin D International Units per c.c.
(Fifty times the vitamin A activity and thirty times the vitamin D activity of good cod-liver oil.)
Prophylactic dose for infants 4–8 minims daily.
Curative dose for infants 12–24 minims daily.

Adexolin (Glaxo laboratories).
Contains 40,000 vitamin A International Units per c.c.
2,000 vitamin D International Units per c.c.
(Equivalent to about 20 c.c. of a good sample of cod-liver oil.)
Prophylactic dose for infants 8–12 minims daily.
Curative dose for infants 16–24 minims daily.

Provision of Vitamin D by Means of Irradiation, Natural and Artificial. If ergosterol is irradiated either in the body or *in vitro*, by ultra-violet light derived from the sun or from artificial sources, it is either converted into vitamin D, or into a substance with exactly the same active anti-rachitic properties. Ergosterol occurs in the body whenever there is cholesterol, and since the latter is present in practically every cell in the body, and particularly abundant in the skin itself, it is evident that when the surface of the body is irradiated by the sun or by artificial means, vitamin D will be produced. As far as its therapeutic influence is concerned it seems to be of little importance whether vitamin D is administered by the mouth or produced in the skin by irradiation on the body, but it is very difficult or impossible to predict how much or how little vitamin will be produced in the body by surface irradiation. The quantity will depend on many variable factors, which include differences in the amount of ergosterol present in the skin and in the tissues, and also on the potency of the irradiation itself.

Irradiation by the Sun. Irradiation by sunlight is greatly influenced by geographical position or latitude—the more vertical the rays, the greater their potency; from this it follows, the nearer the equator, the greater the power of the sun's rays. According to Tisdall, the sun's rays possess little anti-rachitic value in Glasgow for 6 months in the year, while in London they are practically valueless for 5 months in the year. On the other hand, in Baltimore the favourable period is considerably longer, there being 9 months of actinic activity.

The number of hours a day the sun's rays have anti-rachitic value will also vary with the season, and with the geographical position. Light reflected from the sky has some, but less, anti-rachitic potency than direct sunlight. Hence, paradoxical as it may sound, a cloudy sky may have greater actinic value from the point of view of the prevention and treatment of rickets than one of azure blue. Dust, smoke, and window glass obstruct anti-rachitic radiation, so also does ordinary clothing consisting of either cotton or wool. Rayon materials are said to be slightly more permeable.

The intensity of ultra-violet light is also a definite factor. As

regards its therapeutic value it has been computed that a daily exposure of 20 minutes to noonday sun in summer is equal to 3 or 4 hours' exposure in January. The area of skin exposed to irradiation is a further factor, but in good light, and with sufficiently lengthy exposure, a small surface such as that of the face or hands is sufficient to protect against rickets. The thicker or more horny the epidermis, the greater the obstruction to actinic rays, while skin pigment is a second line of defence against excessive irradiation. This is why dark-complexioned children, such as Italians and Negroes, are so liable to develop rickets in sun-starved countries.

The dosage is particularly difficult to control in the case of natural open-air irradiation, but experience has proved that if the whole body without clothing is irradiated in good sunlight, the exposure should not be longer than 5 minutes during the first 3 days of treatment. For the next 3 days it may be 10 minutes, and the third 3 days 15 minutes, and so on, until an exposure of 2 or 3 hours has been attained.

Excessive dosage is followed by actual damage to the skin—namely—sunburn, or dermatitis, or by attacks of heat-stroke. Children who are exposed to excessive irradiation of the sun by direct or reflected light, as for instance while paddling in the sea, are liable to have somewhat serious nervous attacks, not altogether unlike encephalitis, with pyrexia and vomiting. These attacks may last 2 or 3 days and are often erroneously regarded as " bilious attacks " or acidosis.

Artificial Irradiation. The sources of artificial ultra-violet radiation include the following :

1. The Carbon Arc Lamp.
2. The Quartz Mercury Vapour Lamp.
3. The Tungsten Arc Lamp.

These methods of ultra-violet radiation differ both as regards the length of exposure required and the intensity of the resulting radiation. The length of exposure required is dependent on the age of the lamp, the structure of the electrode, and the distance of the patient from the source of light. All these factors introduce a considerable degree of uncertainty into the results. There is no single method yet devised for testing the ultra-violet ray output, or its effect on the patient, although several actinometers or sensitometers have been invented for these purposes. The choice of lamp, the method of employment, and the gauging of the dosage must be left to the expert radio-therapeutist, but the following general statement may be made with regard to the

method of treatment. For more precise details however the reader is referred to Austin Furniss's book on the subject.[1]

Carbon Arc Lamp. With a 30-ampere long-flame arc lamp fitted with iron-cored carbons, an initial dose of 2 minutes is advised for a child placed 3 ft. from the terminals, and this treatment may be continued on alternate days with one-minute increments until a total of 15 minutes' exposure on each side of the body is reached. At least twenty-four applications will be required, after which 1 month's rest may be enjoined, followed by a further course of twenty-four applications. It is always desirable whenever possible to check the results of treatment by X-ray examination of the long bones and by estimations of the phosphorus and calcium content of the blood. Cerium-cored carbons are not nearly so potent as iron-cored, and if used the exposure must be nearly double that recommended above.

Quartz Mercury Vapour Lamp. With a 220- or 230-volt type of lamp, the exposure should be as follows: First application, 1 minute at a distance of 3 ft. Second application, 2 minutes at the same distance. Third application, 3 minutes, and so on, until an exposure of 7 minutes is attained.

With gas-filled mercury vapour lamps the exposure should not be more than half of the above.

Tungsten Arc Lamp. The latest type of this lamp is easy to use, and a rich supply of rays is afforded. The exposure and dosage should be the same as that recommended in the case of the carbon arc.

Over-Dosage. Over-dosage in the case of artificial irradiation may occur, and take the form of burns, erythema, dermatitis, pigmentation, conjunctivitis and loss of hæmo-bacteriocidal power, and in light-sensitive persons symptoms of drowsiness, lassitude, loss of appetite, and irritability, may develop.

Choice of Method. In this country natural irradiation by the sun cannot be depended on excepting during a few months in the year. The advantages however of open-air treatment in suitable weather are so obvious that they need not here be insisted upon, but during the winter months artificial irradiation is the only practical method, and affords most satisfactory results, not the least of which is the shortness of the exposure required.

For prophylactic purposes irradiation by the arc lamp is highly satisfactory, but for curative purposes the Quartz Mercury Vapour Lamp is to be preferred.

Calcium and Phosphorus. The administration of both cal-

[1] FURNESS, Austin: "Ultra-Violet Therapy."

cium and phosphorus must be regarded as an integral part of the specific treatment of rickets. Both these elements are an essential constituent of bone, but bone cannot be built up even in the presence of an ample supply of these elements unless they are presented in an available form. Unfortunately we do not know exactly in what form they are most available. It may be that they must exist in an ionic condition. But whether this is so or not, without vitamin D they cannot be assimilated for bone formation. In rickets the phosphorus certainly, and the calcium usually, is present in deficient amount, but in certain forms of rickets, especially in renal rickets, they may be present in great excess but yet fail to be assimilated in such a way as to form normal bone.

A deficiency in the actual supply of either phosphorus or calcium in the food is probably not a frequent cause of rickets, the cause being rather an excessive demand for these elements for other purposes than that of bone-formation. An existing condition of acidosis creates a great demand for phosphates, which as acid phosphates are excreted in large amount in the urine. In all cases of rickets this possibility must be taken into account and any tendency to acidosis counteracted by the free administration of alkalies, such as bicarbonate of soda, and citrate of potash ; these neutralize the acid radicles and serve as phosphorus and calcium sparers. In the treatment of rickets it should be part of the routine practice to give quite large doses of both bicarbonate of soda and citrate of potash, to prevent the development of a condition of acidosis and to preserve both the calcium and the phosphorus from being excreted in excess in the urine.

Deficiency Symptoms other than those due to Deprivation of Vitamins

No account of the deficiency diseases can be complete without some reference to that large group of deprivation symptoms which are due to inadequate supplies of one or other of the essential constituents of a complete dietary, other than the vitamins themselves, such constituents for instance as the fuel foods and the mineral elements.

As regards the former, starvation in respect to any or all of the great triad of fuel foods, namely, proteins, carbohydrates, or fats, will as surely lead to malnutrition and pathological conditions, as does deprivation of any of the vitamins, but the symptoms due to such deficiencies have not so far been classified or systematized on a rational basis. In the following paragraphs

I have made some attempt to fill in this hiatus in a group of obviously important dietetic disorders.

Symptoms due to total deficiency of all elements excepting Vitamins. Instances of deprivation of all the essential elements, apart from the vitamins, must be very uncommon except in the case of breast-fed infants. With other forms of feeding, or with mixed feeding, there is nearly always a combination of deficiencies and excesses, so that it is very difficult to disentangle the symptoms due to one cause from the symptoms due to other defects. Total deficiencies in food intake are best estimated on a basis of the caloric value of the fuel, but it may be assumed that if the caloric value of the food is below standard, there will be corresponding deficiencies in respect of the accessory food elements also. If in any particular case there is a marked discrepancy between the actual caloric intake and the estimated physiological requirements, a diagnosis of starvation is justified, and some or all of the following symptoms may be looked for.

In the first place, with a restricted intake of the so-called fuel foods (proteins, carbohydrates and fats), there must be a corresponding reduction in the total output of heat or work, as well as some decrease in the rate of growth. In what particular direction the incidence of such shortage will be most acutely felt will depend on a variety of circumstances, but a child will in any case fail to put on a normal amount of weight, will lose in energy, and probably have difficulty in keeping himself warm. The motions certainly, and the urine probably, will be scanty, while the former will lack substance and solidity owing to the want of soap residues. One particularly pathognomonic symptom of prolonged general starvation in the case of babies under 1 year of age, is smallness of the liver, due to reduction in its functional activities, and another characteristic sign is a small and depressed fontanelle. The child will probably have a fairly good colour—anyhow, it will not be sallow, as there is almost sure to be complete absence of intestinal toxæmia. Such a child in fact does not look ill, although it will have no superfluous fat. Apart from these symptoms the evidences of general starvation are negative rather than positive in character.

The treatment is obvious, namely, to increase the caloric value of the food intake to physiological standards (page 113). This increase must only be made gradually, otherwise dyspeptic symptoms will ensue, owing to the relatively undeveloped condition of the digestive organs.

Symptoms due to Protein Deficiency. The total protein requirement of infants and young children is very small provided

the proteins themselves are of good biological value (see pages 7 and 115). Any allowance seriously short of these amounts must be regarded as constituting an insufficiency, and liable to lead to deficiency symptoms.

The chief symptoms of protein deficiency are failure of growth, low resistance to infectious diseases, and a tendency to œdema. Nutritional œdema is pathognomonic of protein deficiency, and is very apt to arise in cases in which, owing to gastric or intestinal disturbances, the child is restricted for too long a period to a protein-free diet, such as glucose saline. The fact that infants suffering from nutritional œdema put on weight rather rapidly, owing to the storage of fluid in the tissues, is highly misleading; so too is the loss of weight which occurs when the œdema begins to subside. In such cases care should be exercised to avoid faulty conclusions.

The treatment of protein deficiency is either to change proteins of low biological value for proteins of a higher grade, or to increase the total quantity. In all cases, the caloric value of the proteins should be raised to physiological standards, but since proteins are of all elements the most difficult to digest, care should be taken to select those which are the least resistant to the digestive processes. Cow's milk proteins though of high biological value, are particularly difficult to digest, especially the casein. They are more digestible in condensed milk, or when the milk has been treated with lactic acid. It may be wise in the case of young babies, or in older children suffering from impaired digestion, to substitute, temporarily, peptonized milk for the ordinary milk dilutions. Etan, which is a proprietary preparation consisting of a variety of peptonized animal proteins, is of high biological value, and very useful as a temporary food in cases in which indigestible proteins are not tolerated.

Symptoms of Fat Deficiency. The normal requirements of fat for infants and children of different ages are given on page 118. A falling short of these amounts must be regarded as likely to lead to deficiency symptoms. The symptoms associated with fat deficiency are mainly those of a deficiency of fat-soluble vitamins, since the latter are not as a rule available for young infants in any other natural form. Fats however, quite apart from their vitamin content, have definite functions to perform in nutrition, and if they are supplied in insufficient amount pathological results or symptoms are liable to ensue. The most important of these arise in connection with the condition of the stools, which owing to the absence of the normal solid constituent of fæces, namely, insoluble soaps, assume the character of so-called "starvation

stools "—stools which are liquid, foul smelling, scanty, and consisting mainly of mucus stained with bile.

The obvious treatment of fat deficiency is to increase the fat allowance, and at the same time to ensure that sufficient calcium is supplied in the food, or in the form of prepared chalk (Pul. Cretæ. Prep.) to form the necessary insoluble soaps. It must be remembered however that all fats are not equally digestible; human butter-fat is better tolerated by infants than the butter fat of cow's milk, or cod-liver oil, or olive oil. Next to human butter-fat, probably the most digestible form in which fat can be administered to babies is in the form of Vitoleum Cream, which is an emulsion of a mixture of different fats, animal and vegetable, with physical and chemical properties very closely approximating to those of human butter-fat.

Symptoms of Carbohydrate Deficiency. The carbohydrate requirements of infants and young children of different ages are given on page 116. Any shortage in the allowance greatly below these amounts may be regarded as a carbohydrate deficiency, calculated to produce its own train of symptoms. These it must be admitted are not particularly pathognomonic, in fact they are rather of a negative character. Combined with carbohydrate deficiency there is almost sure to be a relative excess as regards either protein or fat, or as an alternative, a total deficiency in the caloric intake, so that the symptoms associated with carbohydrate deficiency will either be those of protein or fat excess, or else take the form of a total food deficiency. In the case of infants subsisting on an exclusive milk diet, with a deficiency of sugar or other carbohydrate element, there is usually a tendency to constipated motions, which can be corrected by adjusting the sugar allowance. Constipation therefore may be regarded as one of the symptoms of carbohydrate deficiency. Fat metabolism is so dependent on carbohydrate metabolism that with a deficient carbohydrate intake there may also be a disturbance of fat metabolism accompanied with a resulting ketosis, that is to say, with the presence of acetone or acetone-bodies in the urine.

The treatment of carbohydrate deficiency is simple, and consists in increasing the total carbohydrate intake up to physiological proportions. Whether, however, this increase should consist of starches or soluble sugars, will depend on a number of concomitant circumstances, but speaking generally, if the insoluble carbohydrates are well digested it is better to give them than the soluble varieties, since the latter owing to the ease with which they are absorbed tend to flood the blood with sudden excess, whereas in the case of the insoluble carbohydrates, which are only slowly

digested, there is a higher and more sustained reinforcement of the blood with dextrose.

Calcium Deficiency

The amount of calcium required by the growing infant is considerable, not only for the development of bone, and other tissues, but also for maintenance. It has been calculated that not less than about one-third of a gramme—*i.e*, about 5 grains of calcium —must be retained in the system daily by babies for the purposes of growth—mainly that of bone. The total amount required in the 24 hours for growth and maintenance combined is probably not much less than double this amount—*i.e.* two-thirds of a gramme, or 10 grains. Since 1 litre (35½ oz.) of breast milk contains 0·3 gm. of calcium, a breast-fed infant will not obtain enough calcium unless it takes more than this amount of milk.

On the other hand, cow's milk contains nearly five times as much calcium, and therefore if an artificially fed infant obtains 200 c.c. or about 7 oz. of cow's milk in the 24 hours, theoretically, at least, he ought to obtain enough calcium for growth purposes, though there may not be enough for maintenance. The calcium in cow's milk however appears to be less well absorbed than that of breast milk ; moreover, cow's milk is usually well diluted with water before being given to the infant.

Both in the case of natural and artificial feeding, less calcium is absorbed when an excess of fat is consumed, for most of the unabsorbed fat is converted into an insoluble calcium soap in the bowel, and hence is lost to the body. In conditions of acidosis also less calcium is retained in the body, owing to its excretion by the kidneys in the form of acid phosphates ; hence any excessive fat feeding, or any condition leading to acidosis, will create a greater demand for calcium.

The clinical evidences of calcium deficiency are :

1. A low blood calcium, less than 10 mg. per 100 c.c. of blood plasma.
2. Soft bones due to Osteoporosis or Rickets.
3. Symptoms of Spasmophilia (see pages 557 and 559).
4. Delayed blood coagulation time.

Treatment of Calcium Deficiency. The treatment of this condition by the administration of lime water is inadequate, since lime water contains only about one-tenth of a grain of calcium in every drachm, or less than 1 grain in every ounce. Saccharated lime water however contains about 2 per cent of lime in the form of CaO, so that ½ oz. of it will afford 5 grains. This amount should be sufficient either as a prophylactic or curative dose, but sac-

charated lime water is definitely caustic, and must only be used cautiously and after dilution. Bone and vegetable broth serves as a very useful medium for the administration of lime. As a prophylactic, bone and vegetable broth has great advantages, but from the curative or therapeutic point of view, calcium lactate is more suitable, and should be given in quantities of from 5 to 10 grains daily.

Phosphorus Deficiency

It has been estimated that an infant under 1 year of age requires about 0·4 gm. of phosphorus for every 1,000 Calories of food consumed. A 6-months-old baby usually consumes about 750 Calories of food, and therefore has a phosphorus requirement of about 0·3 gm.

Breast milk contains about 0·03 gm. of phosphorus in every 100 c.c. and therefore 750 c.c. of breast milk would contain about 0·225 gm. of phosphorus, which represents a shortage of phosphorus of about 0·075 gm. in the 24 hours.

On the other hand, cow's milk contains five times as much phosphorus as human milk, and therefore the daily phosphorus requirement of a 6-months-old infant would be satisfied by less than 200 c.c. of cow's milk, that is, if all its contained phosphorus were absorbed and utilized.

It may be assumed that an infant exclusively breast fed hardly obtains enough phosphorus unless additional quantities are supplied independently. On the other hand, infants artificially fed on cow's or goat's milk modifications usually get more phosphorus than they require. The question very naturally arises, does lack of phosphorus have any adverse effect on the nutrition of infants ? If one can judge by animal experiments, the answer must be definitely in the affirmative, for rickets can be produced in rats by phosphorus shortage, and various disturbances of growth can be produced in other animals by lack of the same element. It is difficult to believe that the human infant has any natural immunity in this respect, but all the same, except in the case of infants fed entirely on the breast, it is extremely doubtful whether they ever experience any phosphorus shortage in their diet, since most of the ordinary foods, such as cow's milk, cereals, vegetables, fish, meat, and eggs, usually contain a good representation.

Theoretically, one of the best ways of administering phosphorus to babies, is in the form of glycero-phosphate of calcium, or in one of the many ways in which hypophosphites are provided in proprietary preparations, such as Allen & Hanbury's Byno-Hypophosphites. The efficacy of Sanatogen in the treatment of

debilitated conditions may possibly be explained on the grounds that it is a combination of casein with glycero-phosphate of calcium. Five grains of glycero-phosphate of calcium in the 24 hours represents about a maximum dose. On the other hand, sodium phosphate may be given safely in quite large doses, 5 grains two or three times a day, for instance. It is however questionable whether the phosphorus in this form is as available as in an organic combination, such as glycero-phosphate, or when combined in natural foods.

Iron Deficiency

It has been estimated that an infant's bodily requirements for iron are about 0·0035 gm. for every 1,000 Calories of food consumed. In other words, an infant 1 year old requires about 3·5 mg. of iron in the 24 hours, and a baby 6 months old about three-quarters this amount, namely, about 2·5 mg.

The average content of iron in breast milk was found by Sir John Orr [1] to range between 0·15 and 0·19 mg. per 100 c.c. which means that something like 2½ litres, or more than 4 pints of breast milk would have to be consumed daily by an infant 1 year of age to supply this amount of iron—an obvious impossibility. Since cow's milk contains rather less iron than breast milk, an infant of this age would have to consume a still larger volume, without taking into account the question of dilution.

There can be no doubt that there is in both human and in cow's milk, an insufficient amount of iron without independent supplementation to meet the requirements of infants, a fact which explains the frequent incidence of infantile nutritional anæmia. Fortunately, infants are usually born with considerable reserves of iron stored up in their livers, otherwise there can be no question but that the degree of anæmia commonly present would be still greater. Nutritional anæmia is not always dependent on an absolute shortage of iron in the food. The shortage may be relative owing to the fact that iron is badly absorbed from the alimentary tract, owing to achlorhydric or hypochlorhydric conditions, or because abnormal demands for iron exist in the body for other reasons.

The evidences of absolute or relative iron deficiency apart from the anæmia itself which can be estimated by ordinary hæmatological methods, are a general condition of feebleness, and low resistance to infections of all sorts.

The treatment of iron deficiency is simple : theoretically, only

[1] *Proc. of Royal Soc. of Med.*, Sect. of Comparative Med., Vol. xxviii, pp. 9–15.

very small quantities of additional iron are required, probably not more than 2 mg. daily. In the case of breast-fed infants however, even this small quantity cannot be supplied satisfactorily through the mother, for under the most favourable conditions the mammary glands can only provide the milk with small quantities of iron, probably never more than 0·3 mg. per 100 c.c. Iron both in the case of breast-fed and artificially fed infants, is best administered in the form of citrate of iron. The total daily requirement of 3 mg. of iron can be supplied theoretically by about 5 mg. of citrate of iron, that is to say, about 1/20th of a grain, or in about 8 mg. Ferri. et Ammon. Cit. About 1 grain of citrate of iron given daily ought to be sufficient for an infant 6 months of age, although much larger doses are usually given.

Iron may also be supplied in various organic combinations, such as yolk of egg, raw meat juice, extract of red marrow, and bone and vegetable broth (see page 708). Prophylactically, it is probably better supplied in one of these forms, but curatively and therapeutically more rapid results can be obtained by giving the iron in inorganic form, as for instance in the form of ferrous sulphate (Fersolate G. L.), the dosage being 3 grains daily. In the artificial feeding of infants insurance against iron deficiency is provided by the use of Hæmolac, a dried milk to which an iron salt is added in the process of manufacture.

Iodine Deficiency

There can be no doubt of the importance of iodine as one of the essential elements for general metabolism, for without it, the thyroid gland cannot elaborate its specific secretion, and without this secretion, various symptoms of hypo-thyroidism occur, both in man and animals.

In certain parts of the world, as in Switzerland, New Zealand, and America, there are regions in which there is a deficiency of iodine in the soil, and consequently in the food. In these regions goitre, cretinism, and myxœdema are endemic amongst the inhabitants, and the animals suffer from disturbances of development, high mortality, low resistance to infectious disease, goitre, and partial or complete absence of hair. In those places considerable success has accompanied the artificial administration of iodine as iodized salt for human beings, and salt licks for animals.

The amount of iodine required for the maintenance of normal metabolism is exceedingly small, and it is quite possible that the thyroid gland can use the same iodine over and over again for the purpose of secretion, but there is always a certain amount of iodine lost in the urine and in the fæces. The average excretion

for adults is said to be about 38 gamma (0·00038 mg.) in the 24 hours. It has been calculated that to maintain equilibrium, the minimum intake for a child is about 50 gamma, but for safety about three times that amount, or 150 gamma, is required. Breast milk contains on an average 12·4 gamma per 100 c.c. and consequently 1,200 c.c. (42 oz.) of milk would have to be consumed daily to supply the necessary 150 gamma of iodine; clearly an impossible task for young babies.

Cow's milk as a rule contains even less iodine than breast milk. The average yield from eleven stall-fed cows was found to be 2·47 gamma per 100 c.c. of milk, and of pasture-fed cows 2·9 gamma. These figures would seem to indicate the necessity for supplementary supplies of iodine for breast-fed infants as well as for those artificially fed. The shortage however can easily be made good by minimum doses of iodine. It has been estimated by the Swiss Goitre Commission that a daily dose of 0·1 mg. is sufficient for prophylactic purposes, even in goitrous districts. This represents a dose of less than 1/500th of a grain daily, or 1/70th of a grain once a week. Both for older children and for infants this quantity can easily be supplied by adding to the food iodized salt, which contains 1 part of iodine to every 200,000 parts of salt. Natural deficiencies of iodine in the dietary can be compensated for by employing certain foodstuffs which are known to have a high iodine content. The following foodstuffs fulfil these requirements:

Cod-liver oil contains 910–1,650 gamma per 100 c.c.
Sea-fish contain 36·623 gamma in every 100 gm. by weight.
Sardines contain 62 gamma per 100 c.c.
Seaweed (Irish moss) contains 5,870–536,000 gamma in every 100 gm. of dried seaweed.
Watercress contains 19–44 gamma per 100 gm.

From these figures it may be calculated how much of any one of these mother substances, or how much of any combination of them, must be consumed to supply the required 150 gamma daily. In most cases it will be noticed that the amount is considerable, except in the case of Irish moss and cod-liver oil. Half an ounce of cod-liver oil taken daily would be sufficient to make up for any probable deficiency, and 2·4 gm. (40 grains) of Irish moss would also be sufficient. Irish moss can be conveniently given in the form of a jelly, which may be added to the milk mixture, or taken

[1] The very small quantity of iodine normally present in organic substances such as milk, food, and thyroid secretions, have made the amount, until recently, very difficult to estimate accurately. Now, thanks to the efforts of the Medical Research Committee, more reliable methods of analysis are available.

separately, but for ordinary purposes it is simpler and easier to make up for any iodine deficiency by the independent administration of iodine in the form of iodide of potassium. As previously stated, 1/70th of a grain weekly is sufficient as a prophylactic dose.

Excess Diseases

There can be little doubt that there are almost as many symptoms due to food excesses as there are to food deficiencies, and these may be due to individual excesses, or to combinations of them in which more than one individual food element is involved. Among the many essential elements, there are few or none for which there is not an optimum intake. If this quantity is greatly exceeded there will be some interference with nutrition. In the majority of cases however the limits of tolerance are very wide, and there must be very considerable excess before any serious symptoms result.

The majority of these symptoms are not as a rule immediate. They are deferred, and therefore are liable to escape detection, or to be attributed to wrong causes. In any case they are not so easily recognized or so capable of definition as in the case of the deficiency diseases. In fact there are very few combinations of excess symptoms to which definite names have been attached. All the same, it is quite as easy to kill a baby with excess of total food, or of individual elements, such as sugar, fat, or protein, as it is to kill it by a deficiency of some particular vitamin, or some essential mineral element.

Total Food Excesses.

When we speak of an excessive intake of food without specifying or incriminating any one particular food element, we generally mean that the total amount of the fuel foods consumed, namely, the proteins, carbohydrates and fats, have a caloric value which exceeds the physiological estimate.

With ordinary mixed diets, even when supplementary allowances of concentrates or preparations of the accessory factors are given, any excess as regards the latter is extremely unlikely to be so pronounced as to cause symptoms, but excess as regards the caloric value of the fuel foods is exceedingly common, and indeed often necessary in a badly balanced dietary if sufficient of the accessory factors is to be provided. As a rule it is not difficult to calculate the total caloric value of a mixed dietary, and it is particularly easy to do so in the case of an exclusive milk dietary. The physiological requirements for infants and young children at various ages are approximately as follows:

At	3	months	the	caloric	requirement	is 500
,,	6	,,	,,	,,	,,	,, 750
,,	1	year	,,	,,	,,	,, 1,000
,,	5	years	,,	,,	,,	,, 1,600

If these limits are greatly exceeded the organism will probably be in difficulties in disposing of the superfluity, and symptoms will arise by the calling into play of the various mechanisms which are designed to maintain equilibrium. The superfluity may be got rid of by a number of different expedients, some direct, others indirect. The most direct way is by vomiting or expulsion from the bowel. Another method is by the disintegration of food in the bowel by fermentative or putrefactive processes, with the formation of various decomposition products, which are eliminated directly from the bowel, or indirectly after absorption, by the skin, kidneys, or lungs, with corresponding symptoms.

On the other hand, in spite of what may be a considerable excess, the whole of the intake may be normally digested and absorbed without any manifestation of symptoms of indigestion, and in such cases the excess will be disposed of in one or other of the following ways. Firstly, by storage in the tissues, as fat or glycogen, with corresponding increase in weight and obesity. It will be noted that there is no appreciable storage of protein excess.

A further method of disposing of the superfluity is by its combustion in the tissues, with the production of a corresponding amount of heat. This production of heat, which may be considerable, is compensated for, and the blood temperature thereby maintained at the normal, by dissipation at the exposed surfaces by flushing of the cheeks, by sweating, and by rapid breathing. So long as these combustion or oxidation processes can keep pace with the excessive intake the food material will be burnt up into the normal end-products of CO_2, H_2O, and urea, which are eliminated from the body at little physiological cost, but when the excess outruns the capacity of the body for complete combustion owing to shortage of oxygen or for any other reason, semi-oxidized products of the nature of organic acids, of large molecular size, such as lactic acid, acetic acid, butyric acid, oxalic acid, etc., will take the place of the normal end-products, and will have to be neutralized by any available base, such as sodium, potassium, magnesium, calcium, etc., and thus by excretion become lost to the body. In consequence of this there will ensue a condition of mineral depletion and acidosis.

A final, and highly pathological method of disposal of excess is by its elimination from the body in an unchanged form, for instance, as sugar (glycosuria), albumin (albuminuria), or as mucous or serous discharges from free surfaces of the body.

Briefly summarized then the symptoms or indications of an excessive intake of fuel foods are as follows :

1. Vomiting and diarrhœa : intestinal decompositions and toxæmia.
2. Storage in the tissues in the form of glycogen or fat.
3. Excessive combustion with the production of extra heat, and the disposal of this heat by flushing, sweating, and rapid breathing.
4. Production of semi-oxidized products of combustion, mineral depletion, and acidosis.
5. Glycosuria, albuminuria, mucous and serous discharges.

Treatment. The treatment is obvious, reduce the intake to physiological proportions, or increase the output by exercise or other physiological means. In reducing the caloric intake care must be taken not to reduce the intake of such accessory factors as vitamins or minerals below the required minimum.

Protein Excess.

The physiological fact that breast milk contains very little protein, namely, only 1·5 per cent, is a clear teleological indication that the growing baby only needs, and only gets under normal circumstances, a limited supply of this element. It is quite true that with proteins of low biological value larger quantities may be required than is the case when they are of the high standard of breast milk, but there are no grounds for believing that the caseinogen or the whey proteins of cow's milk are proteins of low biological value, or of much less value for the human infant than those of breast milk. In fact, there is abundant evidence to show that the human infant if fed on cow's milk properly modified to the human standard with respect to the proteins and all other essential elements, can do practically as well as regards rate of growth and general development, as one fed exclusively on breast milk.

The pathognomonic symptoms of protein excess are often not recognized, because for the most part they are not immediate. They are remote and deferred, unless indeed the incidence of the excess falls on a sensitive stomach and induces vomiting of undigested casein curd, and calls immediate attention to some dietetic error.

A good many infants show a surprising tolerance to protein excess, as far as digestion in the stomach is concerned—that is to say, they do not vomit, and there is no noticeable gastric distress. Under such circumstances it is evident that the stomach secretes sufficient hydrochloric acid and pepsin to carry out efficiently the first stages of protein digestion, but it is implicit in such cases of

tolerance that the acid-secreting functions of the stomach must be developed to a very high degree, and that a condition of hyperchlorhydria with all its attendant dangers and disadvantages is likely to ensue later. Infants who early develop this excessive acid-secreting function, in later life manifest definite partiality for protein foods such as meat, fish, eggs, and cheese. They have very large appetites, which are difficult to appease, and which lead to those kinds of secondary troubles to which Dr. Jules Taillens [1] of Lausanne called attention, as due to an acid dyspepsia developing in young children which often produces a wasting and pyrexial condition which is difficult to distinguish from tuberculosis. The more deferred results of hyperchlorhydria are duodenal ulcer, gouty conditions, and liver attacks. Most of the troubles however connected with protein excesses are not associated so much with gastric as with intestinal troubles. If the pancreatic and intestinal digestive functions are unequal to the task of resolving all the protein food consumed into its component amido acid fractions, the undigested residue will serve as pabulum for the proteolytic organisms in the large bowel and lead to intestinal toxæmia, and some form of mucous colitis. The secondary effects of intestinal toxæmia are described on page 223.

It may well be asked what constitutes protein excess, or what are the physiological requirements, for infants and young children of different ages, of protein, and to what extent may these physiological limits be exceeded, without provoking pathological results. Basing the physiological requirements on the amount of protein consumed by the average healthy breast-fed infant, one may say that at 3 months of age the requirement is rather more than one-third of an ounce; at 6 months half an ounce; at 1 year 1 oz.; and at 5 years 1½ oz.; always assuming however that the biological nature of the protein is as high as that of breast milk. It may safely be considered that any excess over 50 per cent of these amounts constitutes an excess, which is likely to produce symptoms. When it is remembered that 25 oz. of ordinary cow's milk contains 1 oz. of protein food, it will be readily understood how easy it is to exceed physiological limits. Rather than allow the quantity of inferior proteins to overstep these limits, it would be better to substitute proteins of higher biological value.

Even though combined gastric and intestinal digestion is adequate for the resolution of all the protein intake into its normal physiological end products, that is to say into peptones or individual amido acids, the organism does not necessarily escape the

[1] *Proc. Roy. Soc. Med.*, Sect. for the Study of Disease in Children, Vol. xxii, p. 1, Oct., 1928.

evil consequences of protein excess. Excessive quantities of amido acids, if absorbed into the blood stream, severely tax the deaminating functions of the liver, and may lead to a breakdown of its metabolic activities. It is quite possible that some of the troubles which are commonly attributed to so-called "liver attacks," may be due to this cause, but overwork of the liver and of the excretory functions of the kidneys owing to the presence of excess of amido acids in the blood must predispose to the breakdown of the normal functions of these important organs.

Briefly stated, the symptoms of protein excess include gastric, intestinal, metabolic, or excretory disturbances of the following nature :

1. Gastric.
   (*a*) Vomiting and other stomach disturbances.
   (*b*) Hyperchlorhydria (deferred result).
2. Intestinal.
   (*a*) Diarrhœa ; foul stools.
   (*b*) Intestinal catarrh ; colitis (deferred result).
3. Metabolic.
   (*a*) Overwork and breakdown of liver function, with symptoms of toxæmia (deferred result).
4. Excretory.
   (*b*) Overwork and breakdown of renal functions, with urinary abnormalities.

Carbohydrate Excess.

Although pathological results invariably accompany a superfluous intake of carbohydrate food, the limits of tolerance are greater than in the case of protein, and the symptoms, if such are produced, are of a less serious character.

The average requirements of children of different ages for carbohydrate foods, whether soluble in the form of sugar, or insoluble in the form of starch, are as follows, for the 24 hours :

At	3	months	2	oz.	are	required.
,,	6	,,	3	,,	,,	,,
,,	1	year	4	,,	,,	,,
,,	2	years	4½	,,	,,	,,
,,	5	,,	6	,,	,,	,,

If these allowances, which are sufficient for the normal requirements of the child, are greatly exceeded, the superfluity will be disposed of in some pathological manner more or less hurtful to the organism as a whole. The resulting symptoms may be associated either with the digestion, or the metabolism of carbohydrate food. If the digestive functions are incapable of dealing with the whole

of the intake, there will be some variety of dyspepsia, which generally takes the form of fermentation in the bowel with the production of such gases as CO_2 or CH_4, which leads to flatulent distension, abdominal pain, dysperistalsis, colic, acidity, or frothy motions. Excess of starches, especially in the case of infants under 1 year of age, is more liable to lead to the above symptoms than excess of sugar, for the reason that the digestion of starch takes place in two stages—firstly, it is converted into the polysaccharide sugar maltose by diastatic enzymes, and secondly, it is inverted into the monosaccharide sugar dextrose, through the agency of the inverting ferment maltase. There is thus a double opportunity for trouble.

On the other hand, soluble carbohydrates such as cane sugar or fruit sugar, have only to undergo one change, namely, inversion into a monosaccharide sugar. Glucose, which is itself a monosaccharide sugar, requires no digestion and can be absorbed straight away into the blood system. Hence with carbohydrate excess symptoms of indigestion are more liable to arise with an excessive intake of starches than with one of sugars, and least likely of all when the sugar is a monosaccharide.

Even in these cases in which an excessive carbohydrate intake is not followed by dyspeptic symptoms, because the digestive processes are able to cope with the situation, none the less the body does not escape damage, for an excessive absorption of carbohydrate elements imposes strains on the organism which are liable to result in some metabolic breakdown. The first of these may be an excessive storage in the form of fat or glycogen with obesity. On the other hand, the superfluity may be oxidized with the production of excess of heat, which must be disposed of in one of the ways described on page 113. A further alternative is that the metabolic processes may be unable to carry out the complete oxidation of the whole of the intake, in which case organic acids of large molecular size, such as lactic, proprionic, butyric, or oxybutyric acid, may be produced, and these must be neutralized immediately by any available bases, such as sodium, potassium, calcium, or magnesium, and lost to the body through excretion, thus conducing to a condition of mineral depletion and acidosis, one of the serious results of which is osteoporosis or the defective calcification of bone. A final stage is total failure of carbohydrate combustion, with glycosuria.

It is impossible to predict what symptoms, or combinations of symptoms will be the outcome of an excessive carbohydrate intake, but even though the less serious of such symptoms are produced, the general condition of nutrition of the organism

will not be as good as when the physiological limits are not exceeded.

The obvious treatment in cases of carbohydrate excess is to reduce the intake to physiological proportions (see page 116).

Fat Excess.

The average physiological requirements of fat by babies in the 24 hours is approximately as follows :

At	3	months	the	fat	requirement	is	1 oz.
,,	6	,,	,,	,,	,,	,,	1½ ,,
,,	1	year	,,	,,	,,	,,	1¾ ,,
,,	5	years	,,	,,	,,	,,	2 ,,

Any intake greater than the above may be regarded as excessive, and in those cases in which there is some special intolerance or fat idiosyncrasy, even these quantities may prove excessive and give rise to symptoms. These may be associated with defective digestion, with failure of absorption, or failure with respect to its metabolism in the tissues.

Fat in itself is not particularly indigestible, but it certainly interferes with the digestion of both proteins and carbohydrates. Its presence in the stomach delays the emptying of this organ, and may consequently predispose to vomiting. If however the gastric functions are not interfered with by excess of fat, and the latter passes on into the intestines, a variety of different results may follow. The fat in question may fail to be split by the various lipases present in the bowel, in which case the fat cannot be absorbed, and will appear in the stools in the form of neutral fats and give them a light-coloured and greasy appearance. In extreme cases in which none of the fat is split in the bowels and the whole appears in the motions, that rare condition called steatorrhœa will arise. On the other hand, although the fat may be well split into its normal end-products, glycerine, and fatty acids, the fatty acids may fail to be absorbed, and appear as such in the motions, or what is more usually the case, in union with sodium, potassium, magnesium, or calcium as soaps. When fatty acids unite with either sodium or potassium, soluble soaps are formed, and as such, in part at least, pass through the mucous membrane of the bowel and reunite with glycerine to form neutral fats ; but a great excess of soluble soaps cannot as a rule be absorbed, and if unabsorbed, may appear in the stools. More usually however the fatty acids unite with calcium or magnesium to form insoluble soaps which cannot be absorbed, but subserve the physiological function of roughage.

It does not appear to be very clear what events determine

whether soluble or insoluble soaps are formed in the bowel out of the fatty-acid radicles, but it is probable that they are dependent very largely on the presence or absence of adequate amounts of calcium and magnesium base in the food. If there is a shortage of calcium, soluble soaps will mainly be formed, and the stools will remain liquid. With an excess of calcium, as in the case of cow's milk feeding, large quantities of insoluble soaps are liable to be formed, and hence the tendency for constipation to result with this method of feeding.

If with an excessive fat intake, digestion and absorption are both good, troubles may possibly arise in connection with fat metabolism in the tissues. It may be deposited in excess in the tissues, with resulting obesity, or it may fail to be oxidized, as in the case of diabetes, with a resulting ketosis or acidosis. Failure of fat oxidation is associated as a rule with failure also in the combustion of carbohydrate.

The necessity for fat as a constituent of the dietary has become far less urgent since the means have been open to us of introducing fat-soluble vitamins into the body in other combinations than those of fats. Infants for instance can now obtain their full quantum of the fat-soluble vitamins A and D, in the pure form, or as concentrates, which when thus supplied obviate the necessity for consuming the large quantities of fat which were formerly necessary.

The treatment of fat excess is comparatively simple. Half-cream or fat-free milks may be employed in the case of infants; and fat foods of all kinds restricted or omitted, in the case of older children on a mixed dietary. When such precautions are made it is essential that a supplementary intake of vitamins A and D, must be provided in the form of one or the other of the many available concentrates mentioned on page 88.

CHAPTER VI

THE NEW-BORN BABY

Care of the Premature Baby

Although in all respects the management of the premature baby demands greater observance of detail than in the case of the full-term normal infant, there are three points which demand special attention, *viz.* :

1. The prevention of infection.
2. The regulation of temperature.
3. The feeding.

1. Prevention of Infection. Premature infants may not be more susceptible to infection than full-time babies, but the results to them are so serious that every possible precaution should be taken to prevent them coming in contact with persons suffering from communicable diseases or other sources of infection. Premature infants should as far as possible be isolated and kept in rooms by themselves, and neither in hospitals nor in private houses should they be allowed to share a room in common with other infants or adults. Common colds, influenza, and sepsis are the forms of infection from which most is to be feared.

2. Regulation of Temperature. Owing to the undeveloped state of the temperature-regulating mechanisms in the premature infant it is extremely important that the nerve centres concerned should not be dislocated by undue strains or shocks, and this is especially true of the period which immediately succeeds birth. It is impossible to exercise too much care in preventing loss of heat by the exposure of the infant's wet skin to cold air. The rapid cooling of the body which takes place owing to the evaporation of surface moisture immediately after birth, or after the first bath, often reduces the body temperature to 90° F. or even lower. To prevent this evaporation and consequent loss of heat the infant should be rapidly dried with a warm towel and wrapped in some non-conducting material such as cotton-wool or soft flannel. For the first few days after birth, or at any rate until

the cord has separated, it is better not to dress the infant in orthodox clothes, but to keep him well wrapped up in an improvised garment made from Gamgee tissue, which should encircle the body one and a half times, and be provided with a flap which can be drawn over the head in the form of a hood. The use of ordinary incubators is not in my opinion a wise or necessary means for keeping the infant warm. An electric blanket (see Fig. 6), the temperature of which can be controlled, is a very efficient substitute, and does not interfere with currents of moving air playing on the skin of the infant's face. The warm stagnant air of an incubator depresses metabolism and interferes with the internal generation of heat. The room should not be kept too

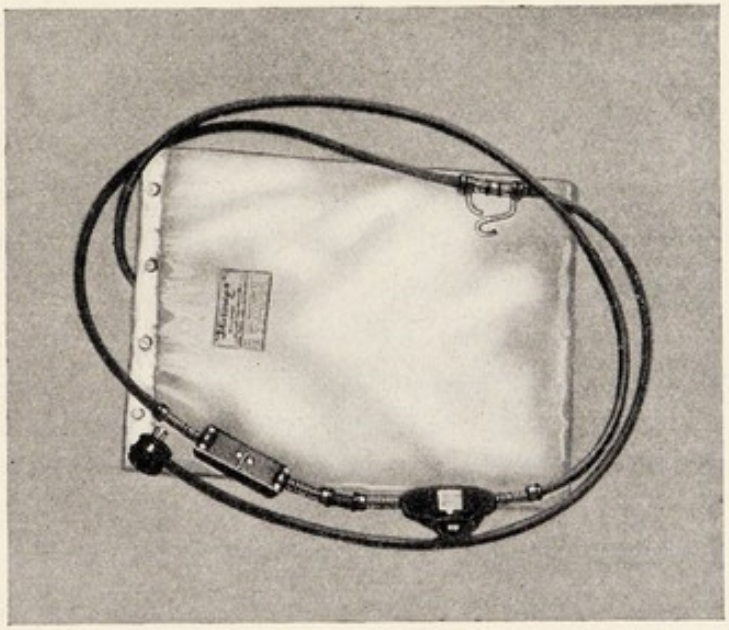


FIG. 6.—The Thermega Electric Warming Pad.

hot, 68° F. is in my opinion the optimum room temperature, and although direct draughts should be avoided, it should be so ventilated that the air is constantly renewed and kept in motion. The basal metabolism of premature infants is set at a very low level, and hence no reasonable precaution should be neglected to stimulate the vital processes by the play of currents of moving air on the face, and by the provision of relatively cool air for the baby to breathe.

The rectal temperature of prematures should be very carefully watched, for it may quite unsuspectedly fall to a low level. A temperature below 90° F. can often be demonstrated in cases in which there are no very obvious grounds for suspecting a subnormal temperature.

Owing to their low basal metabolism the therapeutic use of

thyroid gland is indicated in the case of premature babies. It is quite astonishing how greatly the condition of such infants improves after the administration of small doses of this glandular preparation. The dosage is of some importance, because the temperature may rise to 103° F. or over, if an excessive quantity is given. As a starting-point I find that 1/10th grain of the fresh gland, or 1/50th of a grain of the dried preparation (Thyroideum siccum), for every pound of body-weight, is a good average dose to begin with, but the quantity can be subsequently increased or decreased according to results. To take a concrete case; a premature baby treated in this way had a body-weight of 5 lb. and the initial dose given of the dried preparation (Burroughs Wellcome & Co.) was 1/10th grain $\left(5 \times \frac{1}{50}\right)$ every 8 hours. This dose proved insufficient, as indicated by the temperature remaining sub-normal, and was increased to 1/8th of a grain, with very satisfactory results.

Even without a sub-normal temperature, it is extremely useful to administer thyroid to all premature infants who show any signs of feebleness or weakness.

3. Feeding. *Quantity of Food:* In spite of the fact that the basal metabolism of these infants is extremely low, it is generally advised that the quantity of food given to them should be on a much higher scale than that indicated in the case of normal infants. I cannot help thinking that this view is wrong, and is based on a faulty appreciation of the physiological requirements. The usual allowance advocated is from 70 to 100 Calories per pound of body-weight, as compared with 50 Calories for a normal infant. Personally, I think that 70 Calories should be the maximum, and that 60 is a safer figure provided that the food is breast milk, or a substitute modified correctly to breast standard. If this allowance is accepted as the standard, the exact quantity given at each feed will naturally depend on the total number of feeds given in the 24 hours, or on the intervals between feeds.

The general rule is to increase the number of feeds with the greater degree of prematurity of the baby, and in some cases of extreme prematurity the feeding is advised to be hourly. This however is not my practice, nor do I regard it as a rational one. A premature infant digests more slowly, and absorbs more slowly than a full-time infant, and therefore from these points of view should not be allowed shorter times, but rather longer times between feeds. I am aware that it is usually contended that a premature baby's stomach is so small and can contain so little food without distension that it must be fed frequently if it is not

to be under-caloried, but that is an argument for giving food of high caloric value, and of sufficiently digestible a character, but not for feeding more frequently.

I have for long made a practice of feeding new-born premature infants at three-hourly intervals, with a total of no more than seven feeds, and preferably six feeds, in the 24 hours, just as in the case of full-time infants, and I find that they progress as well, and often better than those who are fed at more frequent intervals, and with very much less risk of disturbances to their digestive functions. Although it is desirable to reach a final standard of 60 or 70 Calories to the pound of body-weight, this optimum cannot be reached safely at once, but should be gradually attained to by daily increments. The following are the exact quantities that I am in the habit of giving:

TABLE XII

TABLE OF QUANTITY OF FOOD FOR PREMATURE INFANTS

	At each Feed.	Day's Total. (Six Feeds.)
1st Day	1 drachm	6 drachms.
2nd ,, ...	2 drachms	12 ,,
3rd ,, ...	4 ,,	24 ,, or 3 oz.
4th ,, ...	6 ,,	36 ,, ,, 4½ ,,
5th ,, ...	8 ,,	48 ,, ,, 6 ,,
6th ,, ...	10 ,,	60 ,, ,, 7½ ,,

and so on, by daily increments of 2 drachms until the full calorie allowance, as calculated on the basis of 60 Calories for each pound of body-weight, is attained. In the case of a baby 2 months premature, weighing 5 lb. at birth, and with an estimated requirement of 300 Calories, it would take 11 days to reach the full amount of 15 oz. in the 24 hours, or 2½ oz. at each feed. As a rule I find that even on this low level of feeding, premature infants gain well in weight during the first few weeks of life.

Quality of the Food. Breast milk is even more important for premature babies than for normal full-time infants, and therefore every effort should be made to ensure that the mother shall nurse her baby. This is sometimes difficult owing to the fact that the mammary glands may not be fully developed at the time of birth, but this is no argument for referring the infant to the bottle. Since premature infants suck feebly and thus afford little stimulus to secretion no expedient should be omitted for stimulating secretion by artificial means, such as massage, alternate hot and cold compresses, and the expression of the secretion by the

manipulative procedure described on page 23. This is specially important during the colostrum period. Milk or colostrum thus expressed may be given by a pipette, spoon, or bottle.

Important as it is to feed the premature baby on breast milk, it is still more important to provide colostrum during the first few days. If sufficient colostrum cannot be obtained by expression, or other means, the only food which should be used during this period as a substitute should be very thoroughly pre-digested breast milk obtained from any available source, or a cow's milk modification of breast standard similarly peptonized. Such a mixture should be given in the form of supplementary feeds to infants who do not obtain a sufficient amount of the natural secretion by their own exertions, or for whom a sufficient amount cannot be expressed from the mother. It is very important that premature infants should not be allowed to tire themselves out by ineffectual efforts of sucking. They should never be left at the breast for more than 10 minutes at a time. If at the end of this period they have not obtained their due allowance as indicated by the "test feed," the deficiency should be made good by a supplementary feeding with spoon or pipette.

Premature infants who are entirely fed by bottle should have their food peptonized very completely for the first few days, but after the usual colostrum period, the time of peptonizing may be gradually reduced by 5 or 10 minutes daily. If this procedure is carried out the peptonizing process should reach zero point in from 18 to 36 days.

In the feeding of premature babies, whether breast fed or bottle fed, the following points should be attended to. They should in all cases receive a greater allowance of the fat-soluble vitamins, of iron, and of calcium, for the reason that unlike full-time babies they miss the normal opportunity of storing up reserves of these elements in their tissues during the 8th and 9th month of intra-uterine life. The simplest and most efficient way of supplying these requirements is to give from 1 to 3 oz. of bone and vegetable broth (see page 708) either independently, or mixed with the bottle feed.

Feeding Bottle and Artificial Teat. Premature babies are often so feeble that they cannot be fed in the orthodox way with the usual type of feeding-bottle and an ordinary artificial teat. Sucking has to be made more easy for them by the use of some simple device, such as using an ordinary fountain-pen filler, or a glass syringe, provided with an indiarubber nozzle or special teat. In certain cases the infant may obtain his food by an enlargement of the hole in the nipple, and in this connection it

may be mentioned that there is no advantage, but rather the reverse, in providing premature infants with very small nipples. The larger the nipple, the easier is it for them to extract milk from the bottle by pressure exercised between the tongue and the roof of the mouth—the ordinary and physiological manner of obtaining it (see page 35).

Initial Loss of Weight

Loss of weight during the first 3 or 4 days of life, due to passage of meconium and urine, as well as to evaporation of water at the skin and lung surfaces, is so invariable that it may be regarded as of no pathological significance. The loss does not usually exceed 5–10 oz., but there may be, relatively to the weight of the baby, a considerable loss, and under normal conditions this is made good by the time the child is from 7 to 10 days old. Loss of weight which continues after the first week should definitely be regarded as of pathological significance, and the reason for it ascertained.

Treatment. Physiological loss of weight can be materially reduced by the supply to the infant of adequate quantities of normal saline, glucose saline, or better—peptonized milk modifications. The giving of unpeptonized milk mixtures or even breast milk from another source during the colostrum period is foredoomed to failure, for during this period no infant, much less one that is premature, is capable of dealing with any kind of food which requires to be digested. No doubt supplementary feeds of colostrum, obtained from some other source than that of the infant's own mother, would be effective if it could be procured, in preventing loss of weight.

In the case of breast-fed infants, the precaution should always be taken by means of the *test feed* to see that the infant does not suffer from serious inanition. If the *test feed* shows that the infant obtains less than ½ oz. of colostrum in the first 24 hours, less than 1 oz. on the 2nd day, and less than 3 oz. on the 3rd day, the deficit should be made good by means of supplementary feeds of a peptonized milk modification. There are certain advantages in limiting the total supply of food during the first few days to what may be regarded as physiological quantities, for a reasonable degree of hunger and thirst affords a natural incentive to vigorous sucking, and this in its turn stimulates the breast, and helps in the establishment of lactation.

In the case of artificially fed babies, who are fed in accordance with the principles enunciated in Chapter III, there is seldom any appreciable loss of weight during the first few days of life.

Inanition Fever

(Dehydration Fever)

Closely associated with the initial loss of weight described in the previous section, is the so-called inanition or dehydration fever, which occurs in about 10 per cent of all cases between the 2nd and 4th day, more particularly in those who are breast fed. To what extent this temporary pyrexia, which rarely exceeds a temperature of 100° F. is due to causes which are suggested by the nomenclature, is to my mind somewhat questionable. If dehydration were the sole cause, why does it occur in only 10 per cent of breast-fed babies, instead of in something like 90 per cent, and the fact that the disappearance of the temperature coincides with the establishment of lactation does not prove that there is any causal relationship between the two processes.

The temperature of new-born babies is in all cases very unstable, owing to the undeveloped condition of the heat-regulating mechanisms, and as a rule there is a considerable initial fall of temperature during the first 24 hours, owing to chilling and loss of heat, so that the subsequent swing back to normal may very easily overstep the mark and result in a slight rise of temperature such as that seen in so-called cases of dehydration fever. But whatever be the explanation of such rises of temperature, they only emphasize the desirability of using the thermometer during the first few days of life, and of safeguarding the infant from serious degrees of dehydration. If this is done, variations of temperature in the new-born, both in an upward and downward direction will be far less often registered than is the case at present.

Treatment. If after the application of the *test feed* the breast fed infant is proved to be receiving an insufficient amount of fluid, the shortage should be made good by supplementary feeds of boiled water. There is certainly no advantage in giving more fluid or more food during this period than is considered physiological, since by keeping the infant in some degree both thirsty and hungry, he receives a stimulation to suck vigorously, and this in its turn helps to promote the establishment of lactation.

Cyanosis of the New-born

The whole question of cyanosis in new-born babies is so closely associated with asphyxia that perhaps it is hardly necessary to deal with the two conditions under separate headings, but cyanosis can occur without asphyxia, although asphyxia, at least blue asphyxia, is always accompanied by cyanosis.

There are four factors concerned in the production of cyanosis :

1. Insufficient oxygen in the lungs.
2. Increased de-oxidation in the capillaries.
3. Low hæmoglobin content of the blood.
4. Circulation of mixed arterial and venous blood (Morbus Cordis Congenitalis).

Cyanosis may be general or local. It may be due to the fact that the blood is not brought into contact with the air in the lungs and thus fails to be oxygenated, owing to circulatory defect (Morbus Cordis), or because the air cannot get to the pulmonary alveoli, owing to mechanical obstruction or failure of respiration, which consequently also results in defective oxygenation of the blood. The latter variety of cyanosis may be due to aspiration of blood, mucus, meconium, or amniotic fluid, into the respiratory passages, or to pressure from outside on the bronchi or trachea. It may also be due to atelectasis or to any condition such as paralysis, which interferes with the normal functions of the diaphragm or respiratory muscles. The commonest cause of cyanosis in new-born babies is blue asphyxia, that is to say of interference with the respiratory function. The next most common variety of cyanosis is local stasis in the capillaries of the feet, hands, and ears, owing to cold or some other factor which causes undue dilatation of the capillaries and blood stasis. A third fairly frequent cause is congenital heart disease.

True cyanosis of the new-born must be distinguished from that intense cerulean pigmentation of the whole body which occurs in Winckel's disease, or infective hæmoglobinuria of the new-born. The slaty-grey coloration of the integuments in this disease is due to the wholesale destruction of the red blood corpuscles, probably from sepsis, it is characterized by the disposition of changed blood pigments in the skin, and by the presence of methæmoglobin in the urine.

Treatment. The treatment of cyanosis due to asphyxia will be described in the following pages : that due to congenital heart disease will be found on page 283. Local and general cyanosis due to cold or circulatory failure should be treated by warmth, massage, thyroid, or adrenalin medication, and by heart tonics.

Asphyxia Neonatorum

It is usual to distinguish two forms of this condition—one in which the prominent feature is a general cyanosis, and the other one in which the skin is of an ashen-grey colour, the former being known as asphyxia livida, and the latter as asphyxia pallida. Although these two conditions tend to merge into one another, it may be better to follow conventional classification and describe

the two conditions separately, with their respective indications for treatment.

Asphyxia Livida. Some degree of cyanosis in new-born babies must be regarded as physiological, since a venous condition of the blood is essential for the stimulation of the respiratory centres and the initiation of automatic breathing. Under normal conditions *in utero* the blood is well oxygenated, hence before birth the respiratory centre is not stimulated, but under certain circumstances in which the placental circulation is interfered with, the blood does actually become venous before labour is completed, and under these conditions the respiratory centre is prematurely stimulated, but it is unable to effect expansion of the chest and entry of air into the lungs, owing to occlusion of the mouth and external nares. This abortive stimulation of the respiratory centres leads to the aspiration of mucus or amniotic fluid into the lung alveoli, as well as to reactionary exhaustion of the nerve cells of the respiratory centre, thus interfering with its normal activities after delivery of the head.

The chief causes of interference with the placental circulation, and of premature stimulation of the respiratory centre, are prolongation of the second stage of labour, premature separation of the placenta from the uterine wall, sub-placental hæmorrhage, pressure on, torsion of, or prolapse of the cord. Asphyxia livida however is quite liable to supervene apart from such circulatory disturbances in cases of prematurity or immaturity. It may also occur as a result of depression or over-stimulation of the respiratory centre by anæsthetic or other drugs administered to the mother during labour. Scopolamine, morphia, strychnine, and pituitrin, are special offenders in this respect.

In addition to the above, there are certain extra-uterine or post-partum causes of asphyxia livida, and these include occlusion of the respiratory passages by the aspiration of mucus, blood, or vomitus, external pressure on the trachea from an enlarged thymus, small hæmorrhages into the medulla, or atelectasis due to any cause.

Treatment. *Prophylactic.* Since prematurity and immaturity are occasionally causes of asphyxia in new-born babies, it is obvious that every practical measure which is calculated to prevent either of these misfortunes will also help in obviating respiratory difficulties. Skilful midwifery will also help to prevent many of those obstetric accidents which lead to hæmorrhage or damage of the respiratory centre.

Curative. Since asphyxia in new-born infants is mainly due to failure of the respiratory centre owing to ante-natal over-

stimulation or exhaustion, or else because there is some mechanical impediment to the entrance of air into the lungs, the rational treatment must consist either in stimulating the respiratory centre itself, or by removing the cause of the obstruction, or both.

The first practical step is to clear the air passages as completely as possible of mucus or other foreign matter by means of a mucus extractor passed down the pharynx as far as the opening into the larynx, or by inversion. The next step is to aid the respiratory movements by intermittent compression of the thorax, by means of manual pressure applied about five times a minute. The elastic recoil of the compressed ribs will almost certainly aspirate some air into the lungs. Advantage should be taken of any indications of spontaneous respiratory movements by making the artificial manipulations synchronize with the natural movements.

While artificial respiration is in progress the infant should be allowed to breathe air charged with both oxygen and CO_2, supplied by a cylinder with a delivery tube and mouthpiece applied to, or in the vicinity of the baby's mouth, or by the passage of a catheter into one nostril. Another way is to allow the gas to escape into some improvised tent under which the infant is placed. In private practice, however, it is not always possible to rely on compressed gas cylinders in cases of emergency, and when this is the case a supply of CO_2 can be provided if the attendant will hold his or her breath for some thirty seconds and then blow the asphyxiated air by means of a catheter into the infant's nose or into its mouth.

Another convenient way of providing CO_2 in cases of necessity is for the doctor to carry a few "Sparklets," or bullets of CO_2 in his obstetric bag. If one of these bullets is pierced so that the CO_2 can escape into the surrounding air, it may be conveniently allowed to empty itself under an improvised tent as suggested above. The only objection to this method is that the concentration of the gas in the air which is breathed cannot be accurately gauged. The concentration of CO_2 should be from 7 to 10 per cent in the compressed oxygen cylinder.

In addition to the above expedients for the establishment of respiration, it is important that the infant should be kept warm, by means of immersion in a hot bath, by hot-water bottles, or by an electric blanket.

As for feeding, it is as a rule inadvisable to make any attempts at feeding until respiration has been established, but small quantities of warm water or normal saline, combined with a few drops of brandy, may be given if the infant shows any disposition to swallow; or with the commencement of independent respiration. Personally, I do not place much reliance in most cases of asphyxia

livida on the use of such drugs as alpha-lobuline, strychnine, coramine, or pituitrin, but when the infant has recovered sufficiently to dispense with all forms of artificial respiration, I believe it to be a good plan to give small doses of thyroid (Thyroideum Siccum), say about one-sixth or one-quarter of a grain three times daily, until the infant gives complete evidence of recovery.

Asphyxia Pallida. Some cases of asphyxia pallida merely represent extreme and exaggerated degrees of the foregoing condition, and are due to exactly the same causes. The term however also covers an entirely different class of case, in which there is severe hæmorrhage or obstetric trauma. Under such conditions the main feature is not so much interference with the respiratory functions as a general state of collapse in which the cardiac, vasomotor, and muscular functions, as well as those of the respiratory centre, are depressed to a dangerous degree. In fact the condition is almost indistinguishable from what is usually called " surgical shock."

The epithet " white " or " pallida " has been applied to this variety of asphyxia in appreciation of the fact that although the blood itself is blue enough, it cannot give the skin a livid colour owing to the fact that it is diverted from the surface of the body to the internal parts, mainly to the large veins of the thorax and abdomen. In asphyxia pallida respiration is suspended, the pulse cannot be felt, and the muscles and sphincters are relaxed. The temperature is sub-normal, and the skin feels cold and clammy, in fact the infant is in a critical condition of collapse, and in spite of the most skilful treatment it is quite likely to perish.

Treatment. *Prophylactic.* As in the case of asphyxia livida, this consists chiefly in obstetric skill. There can be no doubt that the more frequent resort to Cæsarean section in well-equipped maternity institutions, and the gradual disappearance of the old prejudice against the labour ward, is responsible for a great reduction in the frequency with which we meet cases of asphyxia pallida.

Curative. It is almost invariably advised that infants suffering from nerve shock of this kind should be treated with the greatest gentleness, and disturbed as little as possible. It must be remembered however that babies suffering from this degree of asphyxia are in a very critical condition, and that they are unlikely to be saved by conservative means or methods of masterly inactivity. Unless the heart can be set going and the circulation restored, the infant is not going to live. Powerful cardiac stimulants are almost a necessity, and since the circulation is usually in a condition of complete suspense, no useful object is likely to

be served by the oral, or even by the hypodermic administration of drugs. The heart can sometimes be stimulated into activity by manipulation and massage, and in extreme cases can be set going by a direct injection of pituitrin (4 minims), or of adrenalin (10 minims of 1 in 1,000 solution), into the left ventricle.

In less desperate conditions, in which the circulation is not completely suspended, these or other drugs, such as camphor (gr. $\frac{1}{4}$ in 5 minims of olive oil), cardiazol (10 minims), or coramine (10 minims) may be injected intra-muscularly into the thigh or buttock. At the same time, the administration of oxygen and CO_2 should be maintained by some such means as is described for asphyxia livida, and artificial respiration carried out by means of alternate pressure on the thorax and on the abdomen, about five times every minute. Traction on the tongue by means of tongue forceps or a silk suture, kept up in an intermittent manner and synchronized with the movements of artificial respiration, sometimes helps to initiate automatic breathing. Immersion in a hot bath, which need not interfere with either the administration of the gas, or the maintenance of artificial respiration is often helpful in that it obviates the great loss of heat which is one of the characteristic symptoms, and one of the chief dangers, of asphyxia pallida.

Icterus Neonatorum

Jaundice occurs in several forms and in varying degrees in new-born infants, but the prognosis and the results of treatment differ so enormously with the cause that it is of the utmost importance to make a correct diagnosis of the type before treatment is undertaken.

Jaundice is a symptom, and not a disease, and slight degrees of it in new-born infants are perfectly normal, and without pathological significance. It is only when the degree of icterus oversteps the physiological limits that it becomes necessary to take into consideration pathological possibilities. The following are the more common varieties of jaundice met with in the new-born :

1. Physiological Jaundice of the new born. (So-called " simple " type.)
2. Icterus Gravis. (Familial type.)
3. Jaundice due to Sepsis.
4. Jaundice due to Syphilis.
5. Jaundice due to Obliteration of the Bile Ducts, or other congenital malformations.
6. Hereditary Acholuric Jaundice.

There may possibly be other varieties which do not come under

any of the foregoing headings, such for instance as jaundice due to cirrhosis of the liver of other than syphilitic origin, and certain obstructive forms of jaundice, due to extension of catarrhal conditions from the alimentary tract, or to an unduly inspissated condition of the bile. These are of such rare occurrence however that they need hardly be taken into consideration.

Differential Diagnosis. The following points must be given due weight in cases in which a differential diagnosis between physiological jaundice and jaundice of other types has to be made.

Icterus Neonatorum (physiological or simple) appears on the 2nd or 3rd day: improvement sets in almost immediately, and the icterus should disappear by the 10th day. There is no pyrexia, or other constitutional symptom: no hæmorrhage: fæces and urine are normal. Indirect Van den Berg reaction is positive. Red cell count falls rapidly from 6,000,000 to 5,000,000 during the first few days of life.

Icterus Gravis appears on the 1st day; usually begins to disappear on the 10th day. There is bile pigment in the fæces: usually excess of urobilin and bile pigments in the urine. Pyrexia is not present, but other constitutional symptoms are moderately severe. The liver and spleen are enlarged, and there is a tendency to both hæmorrhage and purpura. There may be nervous symptoms. The blood picture is characteristic. There is an erythroblastosis of something like 25,000 immature nucleated red cells per cubic millilitre. There is seldom any fragility, and if there is, it is not severe.

Jaundice due to Sepsis. This develops late. Spleen if enlarged is late in becoming so. There may be pyrexia, omphalitis, or other indications of local or general sepsis.

Jaundice due to Syphilis. This appears later than in physiological jaundice; liver and spleen enlarged; Wassermann reaction positive.

Jaundice due to Obliteration of Bile Ducts, etc. This variety appears late: stools pale, urine bile-stained. Blood picture normal.

Hereditary Acholuric Jaundice. Familial in type. Fragility of red cells. Spleen enlarged.

1. Icterus Neonatorum.

There is always some excess of bile or changed blood pigment in the plasma of new-born infants, due to the breaking down of redundant red cells, a process which represents the physiological adjustment from the polycythæmic condition which obtains before

birth to normal neo-natal conditions of about 5,000,000 red cells per cubic millilitre. In these cases in which the pigment is not sufficiently rapidly excreted in the bile in the form of bilirubin, or in the urine in the form of urobilin, there is some degree of visible icterus, but in something like 40 per cent of all cases, there is no jaundice of the conjunctivæ.

The jaundice generally appears on the 2nd day, but in certain rare instances it is present at the time of birth. It generally begins to improve from the 3rd or 4th day onwards, and should have completely disappeared by the 10th day. During this period there are no constitutional symptoms. Fæces are of normal colour and the urine is pale.

Treatment. Ordinary cases of icterus neonatorum require no treatment, but if the colour does not begin to improve after a week's duration and there are any reasonable doubts as to the exact reason for the jaundice, 5–10 c.c. of whole blood may be injected intra-muscularly in the gluteal region. Such treatment can do no harm, and in practically all cases it exercises a beneficial influence.

2. Icterus Gravis.

This variety of neo-natal jaundice has a strong familial predisposition, but sporadic cases may occasionally occur. The icterus generally appears on the 1st day after birth, but in a few cases it is observable at the time of birth. It generally begins to disappear about the 10th day. Bile pigment is usually present both in the fæces and in the urine. The liver and spleen are enlarged and there is a tendency to both purpura and hæmorrhage. Nervous symptoms due to Kernicterus or lenticular degeneration are not uncommon, and take the form of drowsiness, convulsions, spasticity, or chorio-athetoid movements, but these symptoms are usually late in making their appearance. The disease still has a high mortality, but not nearly as high as before treatment by blood transfusion was instituted.

The blood picture [1] is typical, and is one of erythroblastosis, combined with considerable hæmolysis, with compensatory regeneration of immature red cells, which may reach 25,000 per c.mm., the normal being about 5,000. The blood platelets are sometimes below normal, and there may be some fragility of the red cells.

Treatment. *Prophylactic.* Since the cause of this variety of jaundice is unknown, prophylactic treatment can be nothing else

[1] For further particulars see J. C. Hawksley and R. Lightwood, *Quart. Journ. Med.*, April, 1934, p. 155.

than empirical, but when there is a history of similar symptoms in other members of the family, intestinal and biliary antiseptic treatment may be tried in the case of the mother. Possibly the best form in which to apply this is by giving sour milk (Bacillus Bulgaricus) during the last few months of pregnancy.

Curative. Intravenous injection of citrated blood derived from one of the parents, or from some grouped donor, should be given to the extent of 10 to 15 c.c. per pound of body-weight, and repeated at intervals of 4–7 days, so long as the red cell blood count remains at, or below 4,000,000 per c.c. During the period of treatment, it is particularly important that breast feeding should be continued, and if thought desirable subcutaneous injections of 5 per cent glucose solution should be given to maintain the liver function.

3. Jaundice due to Sepsis.

Owing to the extensive hæmolysis which occurs as the result of sepsis in the new-born infant, there is almost invariably some degree of icterus. Sepsis is not always easy to recognize in new-born infants, owing largely to the fact that it is often unaccompanied by pyrexia. This form of jaundice generally appears considerably later than the physiological variety. There may be evidence of umbilical involvement with omphalitis, thrombophlebitis, thrombo-arteritis, or obliteration of the umbilical vessels. There is usually vomiting, and often diarrhœa.

Treatment. The treatment is that of the underlying cause either by anti-streptococcic serum or by Prontosil (see page 167). The important factor is to identify the nature of the infection, so that the specific serum may be administered.

4. Jaundice due to Syphilis.

This variety of jaundice also appears late—often after the 1st week, and as a rule it is not very intense. It is probably due to a concurrent hepatitis. The liver is large, and so is the spleen. The diagnosis should be clinched by means of the Wassermann test applied to both the mother and child.

Treatment. The treatment described for syphilis (page 161) should be followed, but the prognosis is definitely bad.

5. Jaundice due to Obliteration of the Bile Duct, and other Congenital Abnormalities.

This is a rare variety of obstructive jaundice. It is progressive, but does not as a rule appear till after the 1st week of life. The stools become increasingly paler, and the urine increasingly darker. The liver shows gradual enlargement. There are few constitutional symptoms at first, but the condition becomes

gradually worse, and infants seldom survive more than 6 or 7 months.

Treatment. There is no specific treatment. Surgical interference is useless, and only symptomatic treatment can be applied.

6. Congenital Acholuric Jaundice.

This is a familial and rare form of jaundice in the new-born. As a rule the characteristic symptoms and blood changes come on slowly during later infancy. It is a hæmolytic variety, and only moderate icterus appears during the neo-natal period, but it continues more or less indefinitely. The jaundice is of the disassociated type. Bile pigments are not present in the urine, but urobilin and urobilinogen are generally present in excess. The spleen is definitely enlarged; the liver is sometimes. The red cells are decreased in number, often to about 3,000,000. They are of small diameter (microcytosis 5·9 to 6·4 microns). There is increased fragility (0·7 per cent sodium chloride solution). Van den Bergh's reaction, negative direct, positive indirect. No change in coagulation or bleeding time.

Treatment. *Prophylactic.* None known.

Curative. Splenectomy in later life should be resorted to if the general symptoms and recurrent crises justify such drastic treatment.

Anæmia of the New-Born.

Quite usually some degree of anæmia develops in infants between the 1st and 8th month of life. It is progressive and due to an almost invariable deficiency of iron in both human and cow's milk, but this variety of anæmia is not included among the anæmias properly described as "neo-natal," which develop during the 1st week of life, and are sometimes very severe. Most of these anæmias, at least the less severe varieties, are secondary to syphilis, hæmorrhage, prematurity, or faulty feeding on the part of the mother. In rare instances they are described as being "idiopathic"—in other words, due to "causes which we do not know." Of these there are two chief varieties: one of which appears to be associated with some defect in the hæmopoietic mechanisms, while the second type appears to be due to some active hæmolytic process. In the second type there is evidence by reason of the presence of many erythroblasts in the blood that there is some attempt, though an ineffectual one, on the part of the red marrow and other blood-forming organisms to keep pace with the excessive hæmolyses.

Treatment. In the case of the secondary anæmias, the rational

treatment, both prophylactic and curative, must be directed to the underlying causes, as well as to the actual blood condition ; whereas in the case of the primary anæmias, for want of etiological indications, the treatment can only be empirical or symptomatic.

Prophylactic Treatment. Professor Leonard Parsons has pointed out that there is one particular type of nutritional anæmia in infants which can be prevented by ante-natal treatment of the mother, namely by giving to her both iron and yeast preparations. Dr. John Gibbens and myself at Queen Charlotte's Hospital came to the same conclusion as far as yeast therapy is concerned. We proved to our satisfaction that by giving full doses of Yestamin to pregnant women a great many of the neo-natal troubles of infants, including anæmia, could be prevented. No doubt the addition of iron also would enchance the therapeutic effect of vitamin B preparations in the prevention of anæmia in the new-born.

Curative Treatment. The scientific treatment of the underlying cause, if such can be discovered, must receive appropriate attention, but apart from this, for practical reasons I think the line of treatment adopted should depend on the severity of the anæmia, which can be roughly gauged by the hæmoglobin content of the blood.

For the purpose of simplification the degrees of anæmia may be classified as follows :

1st. That in which the hæmoglobin content is not below 75 per cent.

2nd. That in which the hæmoglobin content is between 50 and 75 per cent.

3rd. That in which the hæmoglobin content is below 50 per cent.

1ST GRADE (75 per cent and over). In these cases it is usually sufficient to treat breast-fed babies through the mother, by giving the latter 10 gr. of citrate of iron and ammonium, or 10 gr. of carbonate of iron, in the form of Blaud's Pills, three times a day, and in addition, if thought desirable, to supplement this with preparations both of vitamin A and vitamin B.

In the case of artificially fed infants, the necessary iron can be supplied in various forms ; as extract of red marrow, 1 drachm three times a day added to the milk mixture ; as bone and vegetable broth (see page 708), 2 drachms added to each feed ; or in the form of citrate of iron and ammonium, given separately and to the extent of 3 gr. in some palatable vehicle.

2ND GRADE (50–75 per cent). In such cases, in addition to the above line of treatment, whole blood to the extent of 10 c.c. may

be injected intra-muscularly, and a liver preparation such as Hepastab, to the extent of 1 millilitre, may also be injected intra-muscularly, and this dose, either with or without the blood, repeated at intervals of 3 or 4 days, until the anæmia has disappeared.

3RD GRADE (below 50 per cent). This group includes the more serious forms of anæmia, which often demand immediate and drastic treatment. Citrated blood to the extent of 50 to 100 c.c. should be transfused intravenously, if possible into the jugular vein, but if such is not sufficiently prominent for this operation, the blood must be injected into the longitudinal sinus through the anterior fontanelle. It is most desirable in either case that the operation should be conducted by a surgeon with experience in the technique. If the blood of the mother or father cannot be obtained for this purpose, the infant's blood should be grouped. Recently a very severe case of anæmia in a new-born infant was brought in a dying condition to The Infants Hospital. The red cell count was under 1,000,000, and the hæmoglobin only 15 per cent. 200 c.c. of grouped blood was transfused into the jugular vein, with an immediate and striking improvement in the child, who survived without the necessity for any further transfusion. We were unable to discover the cause of the anæmia, but thought it must have been due to some internal hæmorrhage, owing to the rapidity of the onset of the anæmia and to the fact that the infant subsequently recovered.

Hæmorrhagic Disease of the New-Born.

Evidence shows that the neo-nate is far more subject to hæmorrhages of varying degree than was formerly thought to be the case. Small hæmorrhages can frequently be discovered in the retina of new-born babies if their eyes are examined with the ophthalmoscope, and many unsuspected hæmorrhages are discovered in the central nervous system and other organs at post-mortem examinations. This tendency on the part of new-born infants to bleed spontaneously is possibly evidence of the existence of the so-called hæmorrhagic diathesis, although some authorities insist that hæmorrhagic disease is a definite entity and is always accompanied by a delay in the coagulation and bleeding times, but inasmuch as both the coagulation and bleeding times are very variable in new-born babies, this argument appears to me to have little relevancy.

Idiopathic hæmorrhagic disease of the new-born must be distinguished from symptomatic hæmorrhages due to trauma, syphilis, or sepsis. It usually occurs between the 1st and 3rd day

after birth, and takes the form of hæmatemesis, hæmoptysis, hæmaturia, spurious menstruation, or melæna, the latter being the most common variety. The cause of the hæmorrhage is supposed to be due to some defect in the quality, rather than in the quantity of the blood platelets, a defect which interferes with the production of prothrombin, and consequently with coagulation, but the cause of this defect is unknown, and hence the propriety of the epithet " idiopathic " as applied to this form of hæmorrhage. In any case, the hæmorrhage is as a rule a temporary matter, and self-limiting, although its cessation is enormously expedited by the modern therapeutic expedient of blood injections.

In his book on " Disease in Childhood," Dr. R. S. Frew has hazarded the suggestion that the tendency to hæmorrhage so common in new-born infants is due to a plethora of blood in their vascular systems. To this condition he gives the name of " Hyperphlebæmia." He claims that it is due to the fact that after birth the blood-vessels of the new-born infant have to carry the total amount of blood, which before birth was distributed between the placenta and the fœtus. His argument appears to me to be perfectly sound, and points to the inadvisability of allowing the placenta to empty the whole of its blood content into the circulation of the infant by a late tying of the cord, or worse still, of the procedure which is called " milking," namely, that of squeezing the placenta by manual expression before the cord is tied or severed. According to Dr. Frew, hyperphlebæmia affords a rational explanation of many other neo-natal symptoms besides that of hæmorrhage.

Treatment. *Prophylactic.* It is usually stated that nothing can be done to prevent these hæmorrhages in new-born infants, but personally I am strongly convinced that much can be done pre-natally by supplying the pregnant woman with full doses of vitamin B complex in the form of Bemax or Marmite, or some yeast preparation. Experimental work on animals certainly strengthens this belief. As a rule however the therapeutic effect of vitamin B in the case of the human mother is not pushed sufficiently far ; much larger doses than are usually taken are necessary to get the best results, and of all the vitamins this particular one is the most likely to be deficient in the dietary of adults and consequently in that of the pregnant woman.

Curative. The treatment of hæmorrhagic disease in the new-born is to inject whole or citrated blood subcutaneously, intra-muscularly or intra-venously. The quantity to be injected, the route to be selected, and the method to be adopted, will depend on the severity of the hæmorrhage. In a case of mild

degree it may be quite sufficient to give one injection of from 10 to 20 c.c. of ungrouped blood subcutaneously, or intramuscularly, but in more severe cases immediate results are better attained by the intravenous transfusion of grouped and citrated blood in much larger quantities, in fact, as much as 100 c.c. or more may be introduced into the circulation by this means.

In addition to blood therapy, calcium in some form, for preference in that of the lactate, may be given by the mouth in doses of 5–10 grains at intervals of 6 hours, until hæmorrhage ceases. Meanwhile the child should be kept quiet and disturbed as little as possible for feeding purposes. The child should not be put to the breast, but fed on "expressed" milk, or a substitute, by means of a pipette or spoon, and it should be kept as warm as possible by means of an electric blanket or hot-water bottles.

Œdema of the Brain and Increased Intracranial Pressure.

It is believed by Dr. J. N. Cruickshank and others that increase of intracranial pressure and œdema may give rise in new-born infants to symptoms of asphyxia, which are difficult to distinguish from intracranial hæmorrhage. The symptoms are bulging of the fontanelle, twitching of the hands and face, irregular respiration, intermittent attacks of cyanosis, and perhaps a tendency to coma. The infant usually takes his food badly, and shows a good deal of restlessness. The main difference between œdema and hæmorrhage is that if, as is usual in the case of œdema, the infant survives, he does not show evidence of permanent injury.

It is not a matter of importance from the point of view of treatment to make a correct diagnosis, as the treatment recommended for œdema is perfectly harmless in cases of intracranial hæmorrhage, and it certainly appears to give satisfactory results when the cause is the less serious one of increased intracranial pressure.

The following method of treatment has for some time past been in general use at Queen Charlotte's Maternity Hospital, in the hands of Dr. Alan Moncrieff,[1] to whom I am indebted for the following particulars of the technique.

Treatment. The method consists of the introduction into the rectum of 2 or 3 oz. of 10 per cent solution of table salt. The fluid is injected by means of a syringe, and catheter, and the buttocks are held firmly together so as to secure retention for as long a period as possible. The injection can be repeated at intervals of 4 hours or more. Additional treatment consists in small doses of chloral, and if the infant is breathing badly, in-

[1] *Brit. Med. Jour.*, 1934, June 16th, p. 1068.

halations of carbon-dioxide and oxygen. Meanwhile the infant should be disturbed as little as possible, and should be spoon-fed with colostrum, expressed from the mother. If the condition is merely one of œdema and congestion of the brain, the symptoms will rapidly improve.

The Umbilicus

Many troubles may arise in the new-born in connection with the umbilicus. The following are the main varieties :

1. Hæmorrhage.
2. Septic Infections.
3. Hernia.
4. Fistulæ, and other abnormalities of development.

1. Hæmorrhage. Bleeding sometimes occurs shortly after birth as a result of careless tying of the cord.

Treatment. As a rule this variety of hæmorrhage is self-limiting, but it can usually be controlled by artery forceps, and the re-application of the ligature.

Later Bleeding. Bleeding which occurs later, at the time of the separation of the cord, may be due to sepsis, or to familial icterus gravis.

Treatment. Apart from pressure, treatment under these conditions (see pages 133 and 134), should be by blood transfusions, or by the intra-muscular injection of hæmostatic horse serum (Hemoplastin, P.D. & Co.) ; the dose is 1 c.c. to be repeated four-hourly until the hæmorrhage stops.

2. Sepsis. The umbilicus is frequently the seat of infective inflammations of varying degrees of severity. The ordinary discharging or " wet umbilicus " which supervenes when the cord falls off at or about the end of the 1st week, usually represents sepsis in a very mild degree, but it may persist for many weeks, and give rise to a good deal of anxiety. The condition may be complicated by exuberant granulations, which fail to become covered with epithelium, and which cause a tumour-like prominence, or indeed an actual polypoid formation. These conditions have to be distinguished from the cherry-red protrusion of an encysted sac in the omphalo-mesenteric duct (see diagram, page 144), and also from adenomata of the umbilicus (see page 143).

Treatment. *Prophylactic.* Careful antiseptic measures in cutting the cord, and the protection of the stump after severance, by dry antiseptic dressings and powders, should prevent the persistence of a suppurating or wet stump. The free end of the cord should be drawn through a hole cut in a pad of protective

gauze or lint, so that it does not come in direct contact with the skin area round the umbilicus, and the cord itself should be thoroughly dusted with an antiseptic powder (see page 704) so that it may be kept dry and mummification encouraged. The whole should be covered up with further layers of gauze, and the latter kept in place by a flannel binder or crêpe bandage. The infant should have no bath after the first one, nor should the dressing be removed, until the cord comes off.

Curative. I have found that the repeated application of tannic acid solution in alcohol (1 in 8) is the best treatment for a " wet " or granulating stump. If the granulations are very exuberant, they may be touched with lunar caustic. With a persistent discharge which is refractory to treatment, the possibility of a fistula (see page 143) should be borne in mind.

Severe Forms of Umbilical Sepsis. Septic inflammation may spread from the umbilicus to the surrounding skin area, and give rise to erysipelas, or it may track downwards in the subcutaneous tissues, giving rise to cellulitis, or gas gangrene; or it may spread along the obliterating umbilical vessels towards the liver, or downwards towards the symphysis pubis, in which cases it may be possible to squeeze out pus by pinching up with the fingers a deep fold of skin below or above the umbilical opening. All these conditions are serious, and may give rise to a general septicæmia or pyæmia.

Treatment. *Prophylactic.* The prophylactic treatment is the same as that described for the prevention of milder cases of suppuration of the umbilicus.

Curative. Medical: Antiseptic dressings of cyanide gauze should be applied to the affected parts, which should be kept clean and as free from pus as is possible by frequent irrigation with perchloride of mercury lotion. If there is suppuration of the obliterating umbilical vessels, they should be emptied by gentle pressure.

Serological and Specific: If the offending organism can be identified, the condition should be treated by the injection of the specific anti-serum. If this is not possible, it is advisable to give the St. Mary's polyvalent anti-streptococcic serum (natural), in the hope that one of its constituent elements may combat the specific organism. The dose should not be less than 10 c.c. In all cases in which resort is had to serological treatment the dosage must be larger than is indicated by the age or weight of the baby.

3. Umbilical Hernia. The umbilical opening is one of the weak spots in the abdominal wall, and readily permits of the

protrusion of a hernial sac. The predisposing causes of umbilical hernia are :

1. An unduly large umbilical cord.
2. Delay in the healing of the umbilical stump.
3. Increase of abdominal pressure from any cause, such as crying, coughing, hiccoughing, etc., or from over-distension of the bowel with food or wind.

Constipation and phimosis are negligible causes, since the new-born infant seldom strains at stool, or on passing urine.

Treatment. *Prophylactic.* Careful attention to the cord, both before and after it drops off, and the avoidance of any of the above causes which lead to increased abdominal pressure, will aid in the prevention of umbilical herniæ. The application of a tight binder is liable to defeat its own end by reason of the fact that it increases abdominal pressure—the main cause of umbilical hernia.

Curative. The treatment of umbilical hernia may be complicated by the presence of an unhealed stump. The necessity for the use of dressings to absorb discharges interferes with the application of pressure at the exact spot where pressure is most needed. Until the stump is properly healed it is only possible to apply a modicum of pressure by means of strapping or bandages. If the stump is actually dry, adequate pressure can be applied easily by means of a bone disc interposed between two layers of strapping with the adhesive side of the lower strip firmly applied to the skin over the umbilical opening. The length of the strapping should be about 3 inches, and it should be so applied as to draw the recti muscles together and invaginate the hernial protrusion. Rubber belts and abdominal binders are contra-indicated as they tend to raise abdominal pressure.

4. Fistulæ, Meckel's Diverticulum, and other Abnormalities of the Umbilicus

Omphalo-mesenteric Duct. During the early stages of embryonic development the omphalo-mesenteric duct connects the vitelline membrane with the rudimentary intestine. This duct should under normal conditions become obliterated at, or about, the 8th week of intra-uterine life, but it sometimes persists wholly or in part. If this canal remains unobliterated in its whole length, it affords an open channel from the small intestine right up to the umbilical opening, or even sometimes a short way beyond and through it, constituting what is known as a *hernia of the cord* (see Fig. 7) in contra-distinction to the ordinary umbilical hernia, which is a peritoneal sac containing a loop of

intestine. If this should be the case, when the umbilical cord drops off, the cap of the hernia may be amputated, and leave a pervious channel between the intestine and the free surface of the umbilicus, through which fæcal matter can escape. This constitutes an omphalo-mesenteric or Fæcal fistula (see Fig. 8). The omphalo-mesentery canal sometimes becomes obliterated in part, so that there may exist a sealed-up portion or cyst, very much of the same character as that seen in cases of encysted hydrocele of the cord. Such a cyst may be continuous with a

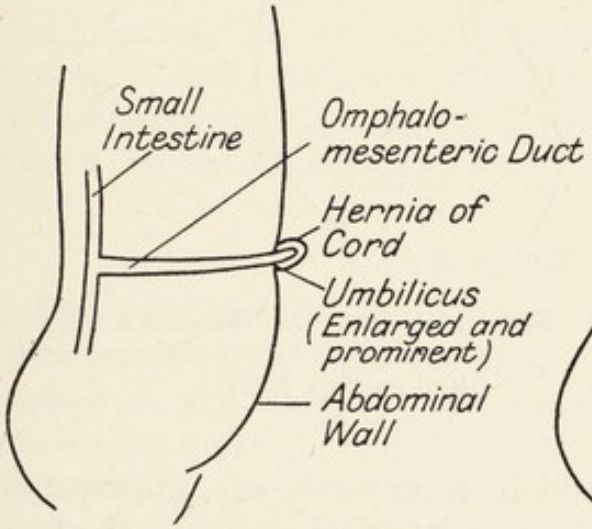


Fig. 7.—Showing persistence of Omphalo-mesenteric Duct, and hernia of Cord.

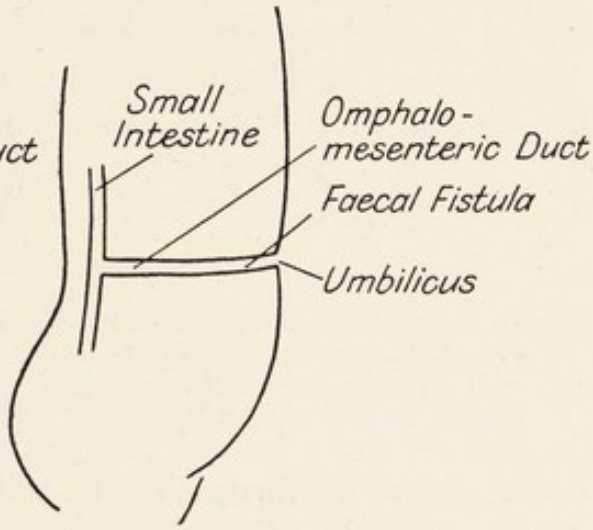


Fig. 8.—Showing persistence of Omphalo-mesenteric Duct, after Cord has dropped off, resulting in a fæcal fistula.

fistula which opens at its free end on the surface of the umbilical stump (see Fig. 9). In such cases there is usually a creamy mucoid discharge, but uncontaminated with fæcal matter. Under such conditions a tumour-like formation sometimes develops from the adenoid tissue of the diverticulum or its remains, and projects through the umbilical opening. A tumour of this nature presents somewhat the same appearance as the simple exuberant granulations or polypoid growths which occur in the case of an unhealed umbilical stump. It is important to distinguish between such an umbilical adenoma and a simple polypus or bunch of exuberant granulations.

Treatment. For the treatment of an encysted omphalo mesenteric duct, a difficult surgical operation is required, as it cannot be dealt with in the simple way that serves in the case of exuberant granulations.

Meckel's Diverticulum. Sometimes the proximal end of the omphalo-mesenteric duct persists and ends blindly in a *cul de sac*,

forming a diverticulum very much like the appendix. This diverticulum which is known as Meckel's diverticulum (see Fig. 10) can end freely, or it can be connected with the umbilical

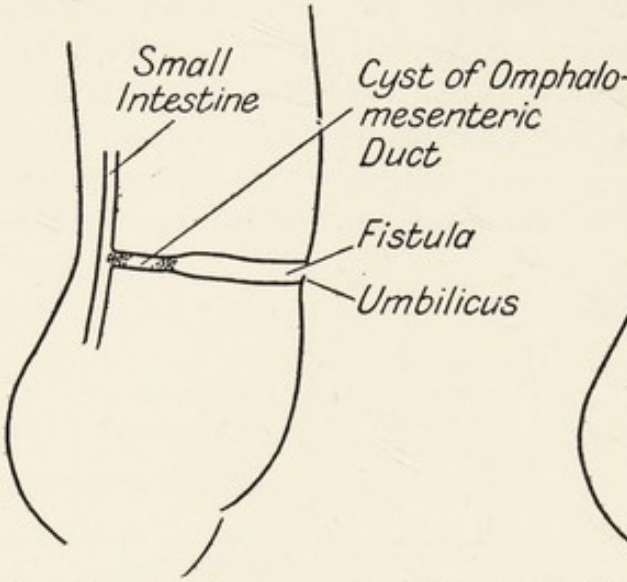


FIG. 9.—Showing partly obliterated Omphalo-mesenteric Duct—the cyst connecting with an open fistula at the Umbilicus.

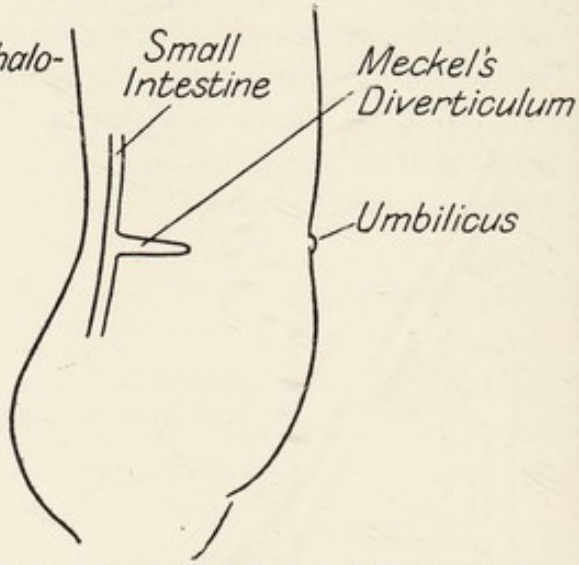


FIG. 10.—Showing Meckel's Diverticulum (*i.e.* Omphalo-mesenteric duct ending freely).

opening by a fibrous cord, which represents the obliterated portion of the distal end. As a rule Meckel's diverticulum cannot be diagnosed during the neo-natal period, but it may subsequently give trouble by causing strangulation of a loop of intestine.

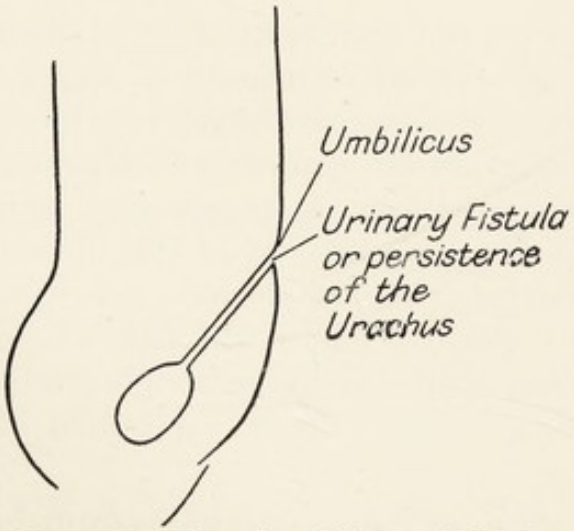


FIG. 11.—Showing Urinary Fistula due to Persistence of the Urachus.

Treatment. *Prophylactic.* There are no known methods of prophylaxis.

Curative. Treatment usually involves a surgical operation, which should only be conducted by an expert.

Urinary Fistula (*Persistence of the Urachus*). Another form of fistula which is sometimes met with, apart from that of the omphalo-mesenteric duct, is that which is due to the persistence of the allantoid duct, a rudimentary structure which connects with the bladder, and which may, if it persists, form an open channel between the bladder and the umbilicus, through which urine may trickle (see Fig. 11). Some-

times this duct is only partly obliterated, and may become encysted in the same way as referred to above in the case of the omphalo-mesenteric duct.

Treatment. *Prophylactic.* There are no known methods of prophylaxis.

Curative. A difficult surgical operation is required.

The possibility of one or other of these rare conditions must always be remembered when dealing with any protrusion at the umbilical opening, or when the umbilical stump fails to become covered with epithelium, and remains the seat of exuberant granulations. Should the secretion from the umbilical stump present a fæcal or urinary odour, the possibility, or rather the certainty, of the existence of one or other of the above mentioned fistulæ should be remembered.

Abdominal Herniæ

There are certain weak spots in the abdominal wall through which peritoneal sacs containing viscera or other abdominal contents may protrude, and thus constitute one of the varieties of abdominal herniæ. Reference has already been made to umbilical herniæ (page 141): other varieties are inguinal, which are very common, femoral, epigastric, diaphragmatic, and internal, all of which are so rare as not to need reference here.

Inguinal Herniæ.

Inguinal herniæ in male babies represent the descent through the internal inguinal ring of a loop of intestine or other abdominal tissue into a persistent peritoneal sac, the *processus vaginalis.*

In female babies it represents a similar descent into a somewhat shortened peritoneal pouch—the Canal of Nück. The reason why these embryonic pouches fail to become obliterated is not clear, but no doubt raised abdominal pressure plays some part in their production, as it certainly does in their persistence.

The main question for the practitioner to decide is whether the palliative treatment by means of a truss is likely to succeed, and if so, what sort of truss to provide. Surgeons generally advise operation on the grounds that even if an apparent cure is effected during infancy, the presence of an unobliterated sac is always a potential danger in later life, for it may predispose to a recurrence of the hernia, and possibly to strangulation.

My own personal experience is that with a well-adjusted truss which completely controls the descent of the hernia, a cure can usually be effected without resort to operative interference. In a small minority of cases, however, the tumour cannot be con-

trolled by any sort of truss, and under such conditions not only should operation be undertaken, but undertaken at the earliest possible moment.

The old-fashioned wool trusses are so difficult to apply, and so inefficient in their action, that for many years past I have completely abandoned their use, and have substituted for them, in the case of male infants, a double pneumatic truss of horse-shoe shape. I advise the use of a double rather than a single pneumatic truss, even for one-sided ruptures, since the former keeps in better position. Pneumatic trusses of this kind are not prohibitive as regards expense. They can easily be kept clean, and owing to their pneumatic structures are not likely to cause sores or excoriations. Such trusses should be worn day and night, and also possibly during the bath, and they should only be temporarily removed for cleaning or drying purposes.

In the successful treatment of a congenital hernia the most important detail is to apply the truss before the hernia has had opportunity by reason of repeated descents to make an easy path for itself.

The question very naturally arises, how long should a truss be worn after the last appearance of the rupture. This is a very difficult matter to decide, and it must depend considerably on the size of the inguinal opening, and on the rapidity with which the latter has closed. With a large opening, descent may occur on straining at any moment. For this reason the opening of the inguinal ring should be frequently examined, and the truss should not be relinquished under any circumstances so long as the hole easily admits the tip of the little finger, or while there is any bulging whatsoever into the opening during crying or straining.

If the rupture recurs in spite of the application of an efficient variety of truss, there is no alternative to operation, and the sooner it is performed the better, so long as the infant is in a good state of health. I have seen many excellent results of operation in infants under 1 month of age.

Irreducible Herniæ.

If a hernia previously reducible, suddenly becomes tense and tender, and can no longer be returned to the abdomen by postural treatment or by gentle manipulation with the fingers, the infant should be placed in the Trendelenberg position, with an ice-bag over the tumour, and sedatives freely given by the mouth. If in the course of a few hours the intestine has not returned into the abdominal cavity, strangulation is to be feared, and an operation undertaken with the least possible delay.

Hydroceles.

A congenital hydrocele, like a congenital inguinal hernia, represents a persistent patency of the *processus vaginalis*. The pouch may be open, though so narrowed at the neck as not to allow of the descent of a hernia, or it may be sealed up at some point of its length, so as to form an encysted sac. Whether open or closed, the pouch contains fluid, which drains into it from the peritoneal cavity, or is secreted by its own walls.

With an open hydrocele the sac can be emptied by pressure, and its contents returned to the peritoneal cavity. In the case of an encysted hydrocele, which is at times mistaken for a hernia, the contents cannot be so emptied, and the tumour has a tense cystic feeling on palpation. A hydrocele is translucent on trans-illumination, and is dull on percussion. By these two physical signs it can be distinguished from a hernia.

Treatment. So long as a hydrocele is not complicated by the co-existence of a hernia, the condition is unattended with danger or inconvenience. If it does not cure itself spontaneously within 3 or 4 years, it should be dealt with by a radical operation. Nothing is to be gained from tapping or from attempts to cause absorption by counter-irritation, but the wearing of a truss does occasionally promote sealing at the neck, and this in itself may be the first step towards a spontaneous cure.

Birth Injuries

Injuries can be inflicted during the act of birth, especially in cases of instrumental delivery, on the skin, soft parts, bones, viscera, nervous system, or blood-vessels. The more common forms of such obstetric trauma will be dealt with in the following sections.

Injuries of the Skin and Soft Parts.

The application of forceps, and especially of Willett's forceps, occasionally causes severe superficial wounds of the skin, which may become septic, or give rise to sloughing or gangrene.

Treatment. *Prophylactic.* Conservatism in the use of forceps, resort to Cæsarean section, and the adoption of antiseptic precautions.

Curative. In spite of the great liability of superficial wounds of the above kind to become septic, the recuperative powers of the new-born are so great that even in the case of the most extensive wounds, if they remain sterile, healing takes place with remarkable rapidity. For this reason, every possible precaution should be taken to prevent access of septic organisms to the

wounds themselves, which should be excluded from the air by the application of well adjusted antiseptic dressings.

Caput Succedaneum.

Although a caput succedaneum is usually regarded as a normal and physiological concomitant of labour, it is as a matter of fact definitely a birth injury due to obstetric trauma. In vertex presentations a caput of the scalp never gives rise to any trouble, and the œdema generally disappears between 7 and 14 days. On the other hand, with face presentations the œdema of the lips and buccal mucous membranes may interfere with sucking and necessitate temporary spoon or pipette feeding.

In breech presentations œdema of the external genitals may result in sloughing or cellulitis, owing to the practical impossibility of excluding fæcal contaminations. Trauma of this kind must always be regarded as a serious complication.

Treatment. Antiseptic precautions to exclude fæcal contaminations.

Cephalhæmatomata.

The common or external variety of cephalhæmatoma represents an extravasation of blood between the bone and its periosteal covering; the right parietal being the bone most frequently involved, owing to the greater frequency of L.O.A. presentations. The tumour is always limited by the periosteal attachments at the free margin of the bone, and hence it takes the exact shape of the bone involved. It never passes over a suture.

Double hæmatomata are occasionally met with, usually over the right and left halves of the occipital bone. Hæmatomata have to be distinguished from depressed fractures, and from cerebral herniæ. Rare varieties of hæmatomata are those which occur between the cranial bones and the *dura mater*; these are known as Hæmatomata Interna, and are seldom diagnosed during life. Another rare form is the so-called Cephalhæmatoma Subaponeuroticum, which represents an extravasation of blood between the periosteum of the cranial bones and the occipito-frontal aponeurosis. In such cases there is an extravasation of blood over an extensive area of the scalp without any definite limitation.

Treatment. This consists in resisting the temptation to aspirate the extravasated blood by means of hypodermic syringe and needle. Absorption invariably takes place spontaneously, though it may be delayed, without leaving any trace of the original tumour. With needling there is always some slight risk of septic infection.

Hæmatoma of the Sterno-mastoid Muscle.

An extravasation of blood within the sheath and among the fibres of the sterno-mastoid muscle, sometimes occurs as the result of rupture of this muscle when traction is exercised on the head in breech presentations, especially when there is excessive rotation of the head. The condition is not as a rule diagnosed till after the 3rd day, when the blood begins to coagulate and organization takes place. These sterno-mastoid tumours probably never lead to true torticollis, although occasionally they lead to a habit of holding the head to one side, which closely simulates congenital wry neck.

Treatment. No treatment is indicated for this condition, and although an indurated mass may be felt in the muscle for some years, there is no shortening, and no torticollis.

Fractures of Bones

Skull Bones. This variety of fracture is comparatively common, and may take the form of a partial or depressed fracture of the outer table, giving rise to the so-called spoon-shaped, or duck-bill fracture, and at other times to simple linear depressions. Fractures of this kind are as a rule of little significance. They generally right themselves owing to the natural elasticity and resilience of the cranial bones. Operations for decompression are practically never called for. On the other hand, fractures of the skull may be complete—that is to say, may extend through both tables of the bone, and lead to internal hæmorrhage with pressure symptoms, or to laceration of the brain substance. Under such circumstances a decompression operation is the only expedient which holds out any prospect of avoiding serious results, such as subsequent epilepsy.

Fractures of Long Bones. Fractures of the humerus and femur are fairly common, and may even take place in Cæsarean deliveries. Fractures of other long bones also occasionally occur.

The treatment of such fractures by the orthodox surgical method of splinting is extremely unsatisfactory, both as regards its final results and as regards the immediate difficulties of nursing, and the physical and nervous disturbances which it causes in the infant. For the last few years I have entirely dispensed with splinting of any kind, and the results have been very much better. Figs. 12–15, Plates I and II are from a series of X-ray photographs shown at the Royal Society of Medicine [1] illustrating the various

[1] PRITCHARD, E., *Proc. Royal Soc. Med.*, Sect. Dis. Child., Vol. xxvii, May, 1934, 22–31.

stages of union in fractures treated in this way, which show the remarkable regeneration of bone and restitution of shaft which can take place without the aid of any artificial splinting.

The bones of new-born babies with fractures, show a remarkable capacity to unite without deformity, shortening, or thickening, even in those cases in which there is initially wide separation and displacement of the fragments. The amount of provisional callus which is thrown out is sometimes very considerable, causing at first great deformity of the limb on external examination, but out of this improvised splinting Nature seems to model a new shaft on exactly the same lines as the corresponding one on the undamaged side, so that in the final issue there is no obliquity in the long axis of the bone and no deformity. The " Divinity which shapes the ends " of fractured bones in new-born babies seems to be of the same kind as that which directs the growth of completely undifferentiated pieces of cartilage, taken from embryo chicks, when allowed to develop under suitable conditions *in vitro*, as has been shown by Honor Bridget Fell,[1] who, in a very beautiful microphotographical film, has been able to demonstrate all the stages of growth in a chick's embryonic femur completely separated from its vascular, nervous, and muscular connections. The specimen was allowed to develop in a nutritive fluid contained in a suitable warm chamber. This striking capacity of rudimentary bones to continue to grow along normal lines in response to some as yet unexplained urge of their own self-differentiating tendencies is well exemplified in the complete regeneration which takes place in the badly fractured bones of my series of cases.

Surgeons and others who have no particular opportunity to observe the repair which takes place in long bones in new-born babies as seen in a series of X-ray photographs, are generally sceptical as to the possibilities of treatment by this method of non-interference. I have already treated more than twenty fractures of long bones by this method, and every one of them has given the most perfect result, both as regards the absence of deformity of the bone itself, and also as regards the general comfort and progress of the infant.

Personally, I believe that the more callus that is thrown out round the ends of the fragments, the better. Further, I am convinced that the amount of callus formed is largely dependent on the friction exercised between the broken fragments on movement. For this reason I make no attempt to immobilize the limb, but permit free movements as far as the infant cares to indulge in them voluntarily. From repeated observations of the

[1] Fell, Honor Bridget, *Biochem. Journ.*, Vol. xxiii, 1929, 767–84.



FIG. 12.—Showing initial displacement of fragments of fractured femur in a new-born infant.



FIG. 13.—Showing deposition of much callus at end of third week.

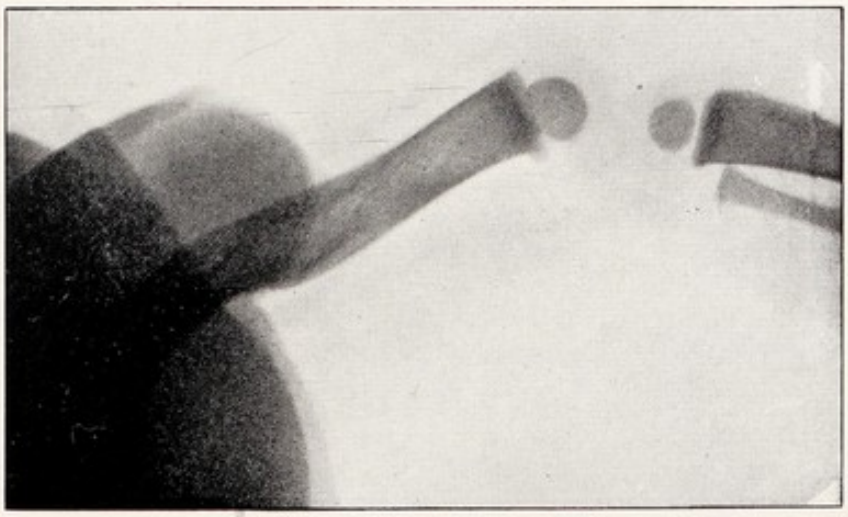


FIG. 14.—Shows resumption of normal shape of bone at $5\frac{1}{2}$ months.

PLATE II

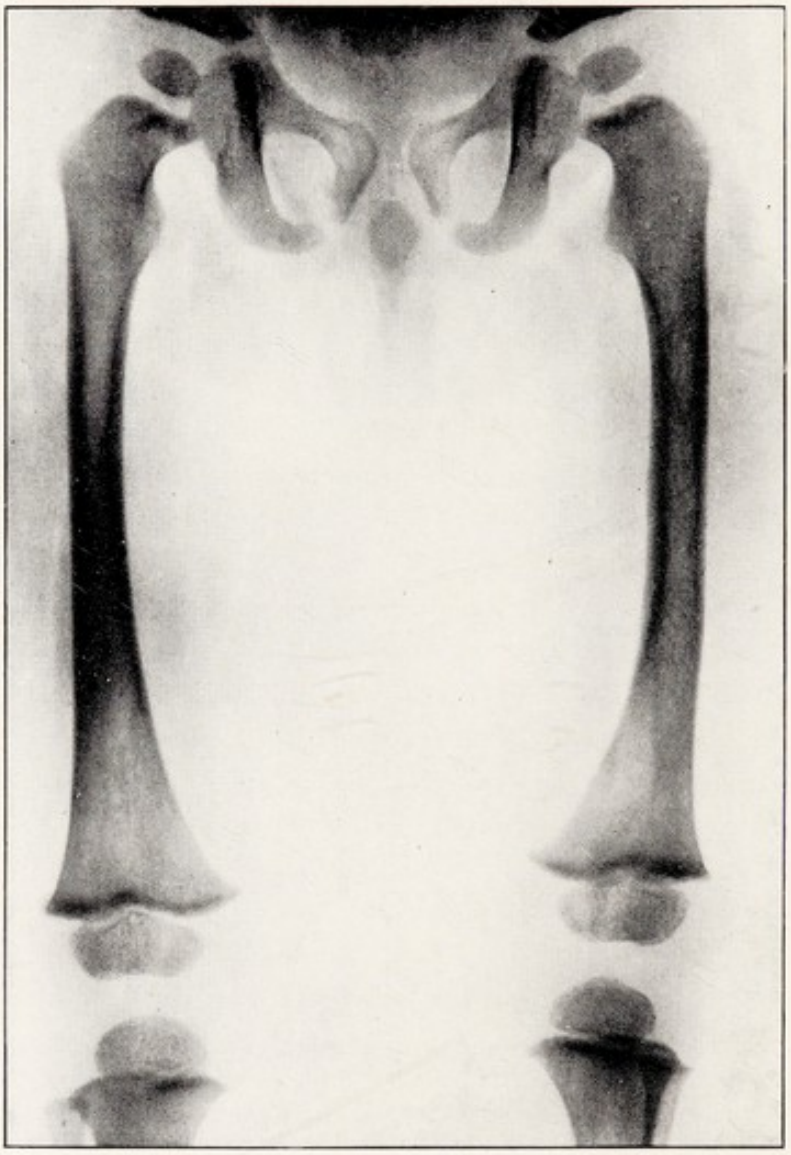


FIG. 15.—Complete recovery of shape of bone at 10 months. Child is walking normally.

(A cinematographic film was shown of this child walking about at the age of 10 months.)

sudden loss of mobility and crepitus between the fragments, which generally takes place at or about the 10th day, I am inclined to believe that the fluid effusion thrown out at the site of the fracture, which contains large quantities of calcium salts in solution, as well as the ferment phosphatase, finally reaches a degree of saturation, which enables the calcium to set in a firm mass analogous to the setting of a Plaster of Paris splint.

Treatment. *Prophylactic.* Very little can be done in the way of prophylaxis beyond taking great care in cases of difficult delivery, not to apply undue traction on the long bones. That these fractures are not always due to excessive degrees of violence is proved by the fact that they can occur in Cæsarean deliveries. The possibility of a fracture however must always be kept in mind. There are moreover varying degrees of bone fragility, due to various causes and dependent in some degree on familial tendencies. The administration of calcium and vitamin D, to the pregnant mother, may have some influence on the degree of calcification that occurs in the infant's bones *in utero*, and these remedies should always be given in any case in which there is any family history of brittleness of bone.

Curative. A fractured limb may be lightly bandaged, but no attempt should be made to reduce the displacement of the fragments, or to set them in improved alignment by any of the usual surgical procedures, such as splinting, extensions, or constrained positions. Care however must be taken in lifting, changing, or washing the infant. In fact, it is better not to bath the infant at all until the fracture is united. To quicken the union of bone, the infant should be given vitamin D in the form of Radiostoleum 5 minims three times daily, and calcium in the form of calcium lactate 10 grains three times a day.

Fracture of the Clavicle. This is another common form of obstetric injury; moreover, it may be double, "green stick," or complete. There need be no anxiety as regards the final result, for as in the case of fractures of the long bones spontaneous union always takes place without any surgical treatment, and even in apparently the worst cases with wide separation and displacement of the fragments, there is no ultimate shortening, neither is there any permanent deformity.

Treatment. Although, if thought desirable, the arm may be bandaged to the side with some backward traction on the shoulder, I do not recommend such attempts to immobilize the parts, as the infant is not likely to make many voluntary movements, and the attendant will naturally take care not to disturb the

such an operation (see page 591), the skull was trephined in the right parietal area, and a considerable quantity of blood-stained fluid removed. The site of the hæmorrhage was not discovered, but the infant made a good recovery, and is still alive. There subsequently developed however a cerebral hernia through an unnecessarily large trephine opening, and the child is reported to be subject to occasional epileptic fits with some impairment of mentality. There is however no spasticity. If I were again required to advise in such a case I would suggest that a flap should be cut (with a pair of scissors) but not removed entirely from its bony attachments. This would enable the flap to be replaced in position to unite by its free edge with the bone from which it had been cut, and in this way the possibility of a hernia avoided.

Visceral Injuries.

Trauma of this kind is comparatively common. Cruickshank discovered 81 such cases in 800 autopsies conducted on new-born infants. Of these 28 were of lung, 15 of liver, 23 of suprarenals, and 20 of kidney. Hæmorrhages of this nature can be very severe and give rise to serious secondary anæmia.

Treatment. As a rule with the rupture of viscera in new-born infants there is severe surgical shock which requires treatment on the lines indicated for asphyxia pallida (see page 130), but whatever procedure is adopted great gentleness must be exercised to prevent a recurrence of the hæmorrhage. We had one case of what we believed to be a ruptured suprarenal at The Infants Hospital, in which the hæmorrhage and secondary anæmia were so great that the infant's lips were absolutely colourless, and the respiration rate almost uncountable. The red cell count was only 800,000 and the hæmoglobin 18 per cent. By the prompt intravenous transfusion of 200 c.c. of grouped blood the infant's life was saved.

Infections of the New-born

The new-born infant possesses at the time of birth a certain degree of passive immunity to those infections to which the mother is herself immune. This is due to the presence in the blood of the infant of the same anti-bodies as are present in the blood of the mother, and to which she herself owes her own immunity. This passive immunity does not however last indefinitely. No one can say in any particular case how long it will last, but certainly not more than a few months in the case of such diseases as measles, diphtheria, small-pox, chicken-pox, and probably scarlet fever also. It appears however to be reinforced

in some small degree by the presence of anti-bodies in breast milk, and more particularly in colostrum, which explains the advantages of breast feeding. New-born infants practically never develop any of the above diseases, but this may be due to the fact that they are seldom exposed to sources of infection, as much as to the protective influence of anti-bodies in the blood.

On the other hand, there are certain forms of infection to which the new-born infant is known to be particularly susceptible, as for instance, the common cold, influenza, sepsis of all sorts, gonorrhœa, syphilis, tuberculosis, and pneumonia; forms of infection to which the infant is frequently exposed and to which the mother may not herself be immune, or from which it is possible she may be suffering at the time of her confinement. Infections may take place *in utero*, through the placental circulation as in the case of syphilis, rheumatism, and occasionally tuberculosis; at the time of birth, as in gonorrhœa; or after birth from abrasions of the skin or through imperfectly protected mucous membranes, by means of food, contaminated air, or direct invasion through any of the orifices of the body, such as the anus, urethra, vagina, or umbilicus.

Infections in the case of the new-born do not necessarily run the same course as they do in the case of older children or adults, and hence their existence may not be recognized, or may be wrongly diagnosed. In the case of new-born infants there is a tendency for infections to become generalized rather than to remain localized in forms which are visible to the eye, or which are capable of recognition by the ordinary means of diagnosis. The mechanisms of defence in new-born babies are very ill-developed. The skin itself offers very little resistance: the mucous membranes are permeable; and the lymphatic system shows no adenopathic reaction or enlargement, and in many cases acute septic infections run their course without any pyrexia, which presumably is evidence of want of metabolic reaction.

My own personal observations lead me to believe that new-born infants occasionally die from certain of the acute exanthemata without developing any rash, or possibly before they have time to do so. The symptoms however that nearly all new-born infants display when suffering from any form of infection are, vomiting, diarrhœa, and dehydration. These symptoms however do not enable one to differentiate one infection from another. To make a correct diagnosis many factors have to be taken into consideration.

Catarrhal Infections (Common Cold or Influenza).

This variety of infection is in my experience very common among new-born infants. It does not however take the same

child unduly in washing or changing his clothes. As I mentioned in the case of fractures of long bones, some movement is desirable, since it promotes callus formation, and the more this artificial splinting material is thrown out, the easier becomes the remodelling of the shaft on its predetermined lines.

Birth Palsies

Facial Paralysis. This variety of birth injury is usually due to pressure of the blades of forceps on the facial nerve, at some point in the neck or on the cheek, distal to its exit from the sterno-mastoid foramen. It is however occasionally due to pressure on some part of the nerves proximal to its exit from the foramen. The paralysis usually clears up in 2 or 3 weeks. If it lasts for 8 months it is probable that there will be some permanent paralysis.

Treatment. As a rule no treatment is necessary, but if the paralysis lasts over 4 weeks galvanism of the paralysed muscles is indicated.

Brachial Paralysis. This paralysis is of two types, that of the upper arm or Erb-Duchenne variety, and that of the lower arm or Klumpke variety.

Treatment. It is important to recognize these two forms of paralysis at the earliest possible moment, for the longer treatment is delayed, the worse becomes the prognosis. The principle on which treatment of both these kinds of paralysis depends, is that of relaxation of the affected muscles before they become stretched. In the case of the Erb-Duchenne paralysis the limb should at once be placed in such a position that the forearm is flexed on the upper arm, and the upper arm raised, abducted, and rotated outwards. This can be done by the immediate application of strapping to the wrist, which must then be pinned to the pillow, with the arm suitably abducted, flexed at the elbow, and supinated. These temporary arrangements can be changed later for a properly constituted aluminium splint. It is always desirable that the services of an orthopædic surgeon should be requisitioned. In the case of the lower arm paralysis slight modification of the above directions must be adopted so as to relax all the paralysed muscles.

Injury to the Spinal Cord.

This is a rare complication. It is practically always fatal if the injury is severe and is of the upper cervical region. Below this point, there is some hope of survival, although the symptoms are those of a transverse myelitis, with paralysis, anæsthesia, œdema, and a tendency to trophic sores below the seat of the injury.

Treatment. This consists in protecting the paralysed parts from injury, the prevention of deformity, and the education of the affected muscles or sphincters.

Hæmorrhages

Intracranial. This variety of hæmorrhage is exceedingly common [1] in cases of still-birth and neo-natal death, and is probably one of the causes of spastic diplegia. The hæmorrhage is generally due to tears in the tentorium or *falx cerebri*, or to laceration of the veins of Galen, or of the tributaries of the longitudinal sinus. The signs of intracranial hæmorrhage are drowsiness, feeble cry, inability to suck, muscular rigidity, twitchings, convulsions, bulgings of the anterior fontanelle, intermittent attacks of cyanosis, irregular respirations, and the presence of altered blood in the cerebro-spinal fluid.

Treatment. Prophylactic. This consists in ante-natal supervision of the pregnant woman, and resort to Cæsarean section in those cases in which there is likely to be excessive moulding of the skull due to any great disparity between the size of the head and that of the pelvic brim. This however does not explain the frequency of intracranial hæmorrhage in cases of prematurity, or in those in which Cæsarean section has been performed. All the same, it is an explanation of the majority of cases of intracranial hæmorrhage. Hæmorrhagic disease of the new-born appears to be a negligible cause of this variety of hæmorrhage. But hyperphlebæmia (see page 138) would seem to be an adequate reason, in all except traumatic cases.

Curative. Careful nursing is essential. If the infant is unable to suck, expressed milk should be given by means of a pipette or stomach-tube. With a bulging fontanelle indicative of increased intracranial pressure, lumbar, ventricular, or cisternal puncture should be performed. Convulsions should be dealt with by the free administration of chloral hydrate or bromide ; control of the hæmorrhage by hæmostatic horse serum, or blood transfusions, is seldom of much advantage, nor is it worth trying, except when there is clear evidence of delay in the coagulation time.

The question of a decompression operation is generally raised in those cases in which a confident diagnosis of intracranial hæmorrhage can be made. It has however been seldom attempted, and less frequently successful. In one case in which I advised

[1] Holland, E., and Lane-Claypon, J. E., *Med. Research Council's Special Report*, 1926, p. 109 ; Cruickshank, J. N., *Med. Research Council's Special Report*, 1930, p. 145.

form as it does in older individuals who may be suffering from a like infection, and who may have been the actual source of the trouble in the baby—the *fons et origo mali.* The common cold is much more likely to cause vomiting and diarrhœa in a new-born baby, than a running of the nose or other coryzal symptoms. The infant in fact suffers from a blood infection, with dehydration and other constitutional symptoms, but without any catarrh of the respiratory mucous membranes. Such infections must be regarded as serious, and in the case of premature or debilitated infants, they are quite likely to run a fatal course.

Treatment. *Prophylactic.* Beyond keeping the infant out of the way of infection, and rigorously excluding him from proximity with all persons suffering from colds, little can be done. New-born babies however are obviously safer when housed in single rooms, or in the country, than when they are in institutional wards, or in towns, where a number of babies may be congregated.

Curative. The symptomatic treatment of diarrhœa and vomiting, should such arise, is important, because if these symptoms are allowed to progress unchecked they are very liable to become chronic and habitual; moreover, they are likely to cause considerable exhaustion. It is a mistake however to regard these symptoms as primarily of dietetic origin, and due to bad feeding. They just as often as not occur in the case of breast-fed infants. None the less, under such conditions, those foods should be avoided which are liable to keep up the symptoms, and temporarily at least, and so long as the infection is in its early and acute stages, the infant should only be given small quantities of glucose saline, or its equivalent, by the mouth, which it can retain without vomiting. If there is much dehydration, fluid may be restored by the subcutaneous injection of 5 per cent glucose saline, up to the limits of absorption. This usually means from 1 to 2 oz. at each injection, which may be repeated six-hourly. Under these conditions sedatives have often a beneficial influence in promoting sleep and in keeping the infant quiet. Opium is the most useful of all drugs, but must be given very cautiously. I generally give it in the form of compound tincture of camphor, and not more than one drop at a time. Chloral hydrate is also useful and safe, and may be given to the extent of 1 gr. at a dose, or potassium bromide may be given to the extent of 4 grs.

In severe and desperate cases blood transfusion offers a better chance of recovery than any other form of treatment. If it is possible " convalescent " blood, derived from a person recovering, or better, who has recovered, from the same infection, should be chosen. The blood should be injected intravenously after

citration and grouping. The amount to be given should be from 2 to 4 oz. and the transfusion may be repeated if necessary at intervals of 2 to 3 days.

Tuberculosis.

The new-born infant is particularly susceptible to tuberculous infection, but as a matter of fact, tuberculosis cannot be diagnosed during the neo-natal period by any ordinary clinical methods, since it produces no symptoms, and the infant may continue in an excellent condition of nutrition. That early infection does occur, is shown by the results of autopsies conducted on infants who have died from tuberculous meningitis, or other independent diseases. Such infants often show by the macroscopic appearance of the lesions that the tuberculous process must have been in existence since earliest infancy. For these reasons we are practically never called upon to apply curative treatment for tuberculosis in new-born infants. All the same, the prophylactic treatment during this period is of the greatest importance, especially in those cases in which the infant is known to be exposed to the risk of infection by reason of its tuberculous environment.

From very considerable practical experience gained in the Out-Patient Department of the City of London Hospital for Diseases of the Heart and Lungs (Victoria Park), I am convinced that no infant has any chance of escaping infection if there is any person suffering from open tuberculosis in its immediate vicinity, and this is specially the case in small tenements or houses in which the mother, father, or other member of the household is the subject of the complaint. Moreover, infection almost invariably takes place early, and during the neo-natal period. It does not follow however that all infants who are thus infected become definitely tuberculous subjects. It sometimes happens, if the dose administered is a small one and the infant is in a good condition of nutrition, that immunity is established. The result depends very largely on the dosage and the frequency with which the infection is repeated.

The best prophylactic treatment of infants born into dangerous tuberculous environments is to remove them at once from the source of danger and place them in safe keeping with healthy foster-mothers. This counsel of perfection can seldom be followed, but it gives the threatened infant a good chance of escaping the serious results of infection especially if its resistance can be raised by preventive inoculation. If the Calmette method of inoculation with an attenuated strain of tubercle bacilli can be carried out efficiently and with safety, no doubt it gives the infant a very good chance of survival, even under circumstances of extreme danger,

but as I have never had any personal experience of this particular mode of treatment, I can only give the bare details as recommended by Calmette himself. They are as follows :

Three doses of 10 mg. of the attenuated culture (B.C.G.) are given by mouth on alternate days, during the first 10 days of life. It is unnecessary to give the culture hypodermically, since the mucous membrane of the alimentary tract is permeable to such material during the first few days of life. That oral treatment of this kind is really effective is shown by the fact that whereas before treatment there is no reaction to an intradermal inoculation of tuberculin, a definitely positive response is given after the second or third dose of the attenuated culture.

Although I cannot confirm by personal experience the favourable reports published by Calmette, and others who have adopted his methods, I can speak confidently of the excellent results which can be obtained by another form of protective inoculation—that of Koch's Old Tuberculin. I used the following method with most gratifying results at Victoria Park Hospital, where I had ample opportunity of testing its merits. The procedure depends for its success on the correctness of the assumption that all infants born into a tuberculous environment must sooner or later be infected with the living tubercle bacilli, which are swallowed with food, or inhaled from the contaminated atmosphere. After sensitization through such fortuitous inoculation, subcutaneous injection of the tuberculin is followed by a mild positive reaction, which does not occur before the introduction of the living bacilli. After sensitization, immunity can be conferred by giving a succession of injections of the tuberculin in progressively larger doses.

The positive and diagnostic reaction to tuberculin which is to be looked for in new-born babies is usually a slight rise in temperature, and occasionally by a focal reaction in the lungs or abdominal glands, with symptoms of coughing, colic, or diarrhœa. Until a positive diagnostic reaction is afforded there is no advantage in pursuing the prophylactic treatment or by increasing the dosage of the tuberculin. The diagnostic dose may have to be repeated two or three times at intervals of a week, before the positive reaction is obtained, which proves the infant has been infected and sensitized, and which justifies subsequent prophylactic treatment.

No doubt the Mantoux intradermal test would from many points of view give a better diagnostic indication of sensitization, but when this line of treatment was begun this test had not been devised, and I continued as I had begun with the subcutaneous method. The details of treatment are as follows :

The diagnostic test consists in the injection of 1/8000 mg. of Koch's Old Tuberculin, and injections of this dosage are continued at weekly intervals until there is a positive reaction; when this occurs it proves that sensitization with the living bacilli has taken place. Prophylactic injections of larger and larger doses are then given at weekly intervals, the size of which is shown in the following series:

1/8000, 1/4000, 1/2000, 1/1000, and so on to . . .
1/250, 1/150, 1/100, 1/75, 1/50, 1/30,
1/20, 1/10 1/9, 1/8, 1/7, 1/6,
and so on to . . . 1mg.

To reach the final dose of 1 mg. inoculations graduated as above have to be continued for something like 6 months. Although this line of treatment is tedious, lengthy, and expensive, it gives such excellent results and is attended by so little risk, that in my opinion whenever it can be carried out it should be attempted.

In all my experience there has been no accident or untoward circumstances to shake my confidence, and out of about 100 cases which have been treated in this manner I have only had one definite failure, and in that case the tuberculous process had proceeded so far before treatment began that there was little reasonable prospect of success.

Feeding. There appears to be almost complete unanimity amongst experts that tuberculosis in the mother is a definite veto to breast feeding. It is claimed that it predisposes to infection of the infant, that it exhausts the mother, and aggravates her tuberculous condition. These assumptions are however purely theoretical and are usually held by authorities who have had no practical experience of breast feeding by tuberculous mothers. On the other hand I always advise mothers suffering from tuberculosis to continue breast feeding, unless there is some definite contra-indication for doing so, beyond the fact that they are tuberculous subjects. Since all infants living in tuberculous environments are bound to get infected sooner or later, it does not materially increase the danger if they are breast fed, and breast feeding certainly gives them the best chance of acquiring immunity by reason of the protective bodies present both in the milk and in the colostrum, and also because such feeding is better calculated to maintain nutrition at the required standard.

From the point of view of the mother herself, I have never been able to convince myself that nursing has any more prejudicial influence on her nutrition, or on the tuberculous process, than pregnancy itself. It is well known that during pregnancy the

condition of the tuberculous woman greatly improves by reason of the stimulating influence which it affords to metabolism in general. It is also a well-known fact that after the birth of the child when the stimulation is withdrawn, her condition rapidly deteriorates, and there is a great accession of activity in the tuberculous process. In a lesser degree I feel sure that lactation itself has the same beneficial influence on metabolism, and as long as it is maintained, the general condition of the mother is much more satisfactory than when lactation has been suppressed, or discontinued.

Ophthalmia Neonatorum

It is often incorrectly assumed that a case of acute conjunctivitis occurring in an infant shortly after birth is gonococcal in origin. Possibly as many as 30 per cent of all cases are due to other infections of a catarrhal, staphylococcal, streptococcal, or pneumococcal nature. Unless there is other confirmatory evidence of the precise character of the infection, the discharge should be submitted to bacteriological investigation.

Inflammation of, or discharge from the eyes of new-born infants, however slight, is considered by the Central Midwives' Board to be so serious a condition that in their Regulations they insist that if any case of the kind occurs in the practice of the midwife, it must be immediately notified to the local supervising authority, and the assistance of a registered medical practitioner invoked.

The inflammation is usually localized to the eyes, but may extend to the lachrymal sac, or even to the nose. Moreover, it may become generalized, giving rise to a general blood infection or septicæmia, generally with fatal results.

Treatment. *Prophylactic.* In cases in which it is known that the mother is suffering from a gonococcal infection, or from any other form of vaginal discharge, every possible precaution must be taken to prevent infectious matter gaining entrance to the infant's eyes. Before birth, or actually during labour the vaginal passages should be irrigated with a mild antiseptic solution, and after birth the infant's eyelids and surrounding parts must be immediately wiped with sterile lint, and 2 drops of 1 per cent nitrate of silver solution, instilled into each eye (Credé's Method). Some ophthalmic surgeons regard this procedure as too drastic, and as liable to set up an independent inflammation of the eye, and for this reason suggest 2 drops of acriflavine in castor oil (1 in 1,500), or of a 10 per cent solution of argyrol or protargol. There can be no doubt that since the introduction of Credé's method, or its modifications, as a routine prophylactic measure, the total

number of cases of ophthalmia neonatorum has been greatly reduced.

Curative. The results of neglect of immediate treatment are so serious that every possible step should be taken to limit the inflammation after infection has taken place. In such cases each eye should be gently irrigated with a solution of warm boracic lotion at frequent intervals. Special care should be taken to remove all accumulations of pus from beneath the eyelids. This may be repeated at intervals of from 1 to 4 hours, according to the severity of the inflammation. To prevent soreness of the skin surrounding the eyelids, these parts should be smeared with boracic ointment. After irrigation, 1 drop of acriflavine in castor oil (1 in 1,500) should be instilled into each eye.

Congenital Syphilis

Infants are sometimes born alive with the symptoms of syphilis already developed, but more usually evidence of the existence of the disease is delayed till 2 or 3 weeks after delivery. In all cases, however, in which the mother, or indeed the father, is definitely known to have syphilis, and whether the mother has been treated or not, also whether the Wasserman reaction in her case or in that of the baby is negative or positive, prophylactic measures should always be taken to ensure the safety of the infant.

Treatment. *Prophylactic.* The first and most important step in prophylaxis is to prevent by contraceptive, or by other available means, the risk of a syphilitic infant being brought into the world. It is impossible to say how long after infection, or how long after the commencement of treatment, a syphilitic man or woman can be considered safe to become a parent, but speaking generally, it may be assumed that a woman is not likely to be entirely free from infection for something like 3 years after treatment has commenced ; and in the case of a man it is probable that he must submit to 2 years of continued treatment before he can be considered safe to become a father. In spite of these generalizations, experience proves that in the case of a syphilitic woman, if treatment is commenced so late as from 3 to 6 months before delivery, she may still bear a healthy baby, or at least one in whom the complaint is so attenuated that it can be readily cured by specific therapy.

Treatment of the Syphilitic Mother before and during Pregnancy. The following treatment should be commenced at the earliest possible moment after the diagnosis has been made :

1ST WEEK. Injection of 0·3 gm. neo-arsenobenzene (neo-kharsivan). The injection should be made into a prominent vein (median-basillic) at the bend of the elbow. This should be followed by the daily administration of 4 gr. of Grey Powder (Pul. Hyd. *c.* Crete) in divided doses by the mouth.

2ND WEEK. Ditto.

3RD WEEK. Injection of 0·45 gm. neo-arsenobenzene.

4TH AND 5TH WEEKS. No treatment.

6TH WEEK. Injection of 0·45 gm. neo-arsenobenzene.

7TH WEEK. Ditto.

8TH WEEK. Daily administration of 4 gr. Grey Powder, in divided doses by the mouth.

9TH WEEK. Ditto.

10TH WEEK. Injection of 0·45 gm. neo-arsenobenzene, followed by the oral administration of 4 gr. Grey Powder daily in divided doses.

11TH WEEK. Oral administration of 4 gr. Grey Powder daily in divided doses.

12TH AND 13TH WEEKS. No treatment.

14TH WEEK. Bi-weekly intra-muscular injections of 0·02 gm. Thio-bismol, dissolved in 5 minims sterile water.

15TH TO 19TH WEEKS. Ditto each week.

20TH AND 21ST WEEKS. Omit all treatment.

22ND WEEK, AND ONWARDS, repeat the whole of the above course of treatment.

It is difficult to say how often and at what intervals the above course should be repeated. It will depend largely on the result of the Wasserman test, and the general response to treatment, but speaking quite generally, it may be said that from three to four courses should be given during the 3 years, for which time continued treatment is recommended. In any case, one or more courses of treatment should be given during any intercurrent pregnancy. The treatment of the father should be carried on simultaneously with that of the mother. The treatment of complications arising in the mother should be pursued on the same lines as indicated below in the case of the infant.

Treatment (*of the Infant*) *:* (*curative*). All infants born of syphilitic mothers, whether they show symptoms or not, should be treated more or less on the following lines, but it must be remembered that if the mother herself is also undergoing a course of treatment, and is feeding her baby herself, somewhat smaller

doses of the specific remedies than those mentioned below should be given to the infant.

Infants who show symptoms of syphilis at the time of birth must always be regarded as being in a critical condition, and must be treated with the greatest gentleness, since they sometimes react violently to the treatment, especially to the arsenical preparations, and under such conditions it may be wiser to begin with a short course of mercurial inunction before the regular course of treatment described below is commenced. The intravenous injection of neo-arsenobenzene is no doubt the most effective means of killing the syphilitic spirochœte, but the attendant troubles of carrying out the technique of this method are often so great owing to the difficulty of finding a sufficiently large vein to take the needle, that on the whole it is better to be content with the less satisfactory method of injecting one of the Sulpharsenobenzene preparations (Sulphostab, Kharsulphan, Sulpharsenol, or Sulpharsphenamin) intra-muscularly, a very much simpler operation. The dosage generally recommended is $\frac{1}{10}$ of a grain for every pound of body-weight or 0·01 gm. for every kilogram of body-weight. Thus a baby weighing 8 lb. would require a dose of $\frac{4}{5}$ of one grain.

The Sulphostab, or whatever preparation is used, should be dissolved in cold sterile water and filtered before injection, and the dose should be repeated weekly for the prescribed length of time. The course of treatment should also include the administration of bismuth, most conveniently in the form of a dilute solution of Bismostab (Boots), which is made up in isotonic glucose solution of the strength of 3 grains of bismuth to every 70 minims of glucose solution, *i.e.* 4 per cent. The initial dose of this dilute solution should be 4 minims (0·25 c.c.) for an infant weighing 8 lb. with larger doses subsequently in accordance with the age and size of the baby. This bismuth treatment may be carried out simultaneously with that of the Sulpharsenobenzene injections, but it should not be combined with the mercurial treatment. The latter should consist of both oral administration and inunction, as ordered in the following course of routine treatment.

1st Week. One single intra-muscular injection of $\frac{2}{3}$ of a grain (0·04 gm.) Sulphostab. $\frac{1}{4}$ gr. of Grey Powder twice daily. Daily inunction of 10 gr. Mercurial Ointment, (Unguentum Hydrargyri).

2nd Week. Ditto.

3rd Week. One single intra-muscular injection of 1 gr.

(0·06 gm.) Sulphostab. ¼ gr. of Grey Powder twice daily. Daily inunction of 10 gr. Mercurial Ointment.

4TH WEEK. Ditto.

5TH WEEK. One single intra-muscular injection of 1⅓ gr. (0·08 gm.) Sulphostab. ¼ gr. of Grey Powder twice daily. Daily inunction of 10 gr. Mercurial Ointment.

6TH WEEK. Ditto.

7TH WEEK. Omit Sulphostab injection. Continue ¼ gr. Grey Powder twice daily. Continue daily inunction 10 gr. Mercurial Ointment.

8TH WEEK. Ditto.

9TH, 10TH, AND 11TH WEEKS. Omit all treatment.

12TH TO 19TH WEEKS (INCLUSIVE). Give daily intra-muscular injections of 5 minims (0·3 gm.) dilute Bismostab solution.

20TH TO 23RD WEEKS (INCLUSIVE). Omit all treatment and apply Wasserman test.

24TH WEEK, AND ONWARDS. The above course may be repeated with gradually increasing dosage of the Sulphostab to 0·1 gm. and of the Grey Powder to ½ gr. twice daily.

Similar courses may be repeated at intervals of 3 or 4 weeks until the end of the 2nd year. The frequency however, and the total number of courses, will depend on the response to treatment and the presence or absence of the Wasserman reaction.

Treatment of Complications.

ANÆMIA. During the specific treatment of syphilitic infants, symptoms of anæmia, sometimes of a very severe character, may supervene. Under such conditions it is desirable to give a course of intensive iron treatment. This may take the form of citrate of iron and ammonium (Ferri et Ammon. Cit.), 5 grains three times a day, or of syrup of iodide of iron (Syrup. Ferri Iodidi) to the extent of ½ to 1 drachm three times a day. In very severe cases the intravenous transfusion of grouped citrated blood proves very valuable.

CHOROIDITIS, IRITIS, CYCLITIS, AND INTERSTITIAL KERATITIS. These conditions do not often arise during the neo-natal period, but should they do so, they should be treated systematically by protection from light, irrigation of the eyes with boracic lotion, and the application of small quantities of Golden Ointment (Unguentum Hydrarg. Ox. Flav.). In all cases the advice of an ophthalmologist should be invoked.

SNUFFLES. Nasal discharges should be treated by irrigation of

the anterior nares with boracic lotion, or glycothymoline (1 in 8) and after douching, a small quantity of dilute ammoniated mercurial ointment should be applied to the nostrils.

Anal Condylomata, and Mucous Patches. The parts should be kept scrupulously clean by washing with warm boracic lotion, drying well with lint or cotton-wool, and then dusting thoroughly with powder consisting of calomel (1 part) and Kaolin (10 parts).

Intolerance of Mercury. Occasionally young infants show intolerance of mercury when administered by the mouth, by symptoms of dyspepsia, which take the form of green stools, colic, or vomiting. Under such conditions the administration of mercury by the mouth should be suspended and given only by inunction.

Intolerance of Bismuth. Symptoms of bismuth intolerance are very much those of intolerance of mercury. There is loss of appetite, apathy, and albuminuria. Under such conditions all bismuth treatment must be suspended, and even mercury itself used with greatest caution.

Intolerance of Arsenical Preparations. The symptoms of this are mainly of a nervous character, jaundice, exfoliative dermatitis, erythema, urticaria, herpes, and albuminuria. With definite intolerance the treatment must be confined to alternating periods of treatment with bismuth and mercury.

Feeding and General Management. It is more important for a syphilitic baby to be breast fed than for a healthy one. Every effort should therefore be made to secure human milk for the infant. If the mother is undergoing a course of treatment, the dosage of all the specific drugs prescribed for the infant should be reduced in quantity. If for any reason the infant cannot be fed directly by the mother, the milk should be expressed, or breast milk from other sources should be given in a bottle.

Infants showing definite symptoms of congenital syphilis cannot infect their own mothers through suckling, even though the latter show no manifest symptoms of syphilitic disease (Colles's Law). A syphilitic infant should not be suckled by a healthy wet nurse, but the latter's milk may be expressed and given in a bottle.

It must be remembered that syphilitic babies are highly infectious, through the medium of nasal discharges, or secretions from the mouth or anus. In all cases precautions against infection must be taken.

The general management of the syphilitic baby must be conducted on the most approved hygienic lines. Chill must be avoided

and open-air treatment encouraged. The skin must be kept clean, especially when inunction of ointment is practised. The urine must be tested from time to time for albumen or other abnormal constituents.

Septic Infections

Septic infections are extremely common in the case of the new-born, and they often run a rapidly fatal course without any rise in temperature, and without local evidence to show by what means or by what route the infection has occurred. In such cases an infant may die of symptoms of diarrhœa, vomiting, cerebral congestion, coma, fatty degeneration of the liver, and hæmorrhages. In other instances there may be local reactions to indicate the focus of infection, as, for instance, the skin may become the seat of erysipelas, gangrene, or pemphigus, or the mucous membranes the seat of inflammatory catarrhs. The connective tissues may give evidence of cellulitis, and the serous membranes of inflammations, such as pleurisy, peritonitis, or pericarditis. The bones may become the seat of osteomyelitis, or the blood-vessels the seat of arteritis or phlebitis. In other cases there may be multiple abscesses of the liver and other viscera. It is quite possible that Buhl's disease (acute fatty degeneration of the liver), and Winckel's disease (infective hæmoglobinuria of the new-born), may represent special forms, possibly mixed forms, of septic infection. The organisms which are mainly responsible for sepsis in the new-born are streptococci, especially the hæmolytic varieties, staphylococci, pneumococci, meningococci, gonococci, the bacillus coli, and the bacillus influenzæ. The channels of infection are the mucous surfaces, the skin, and the umbilicus. Owing to the permeability of the mucous membranes and the macerated and unprotected condition of the skin in new-born babies, there need be no demonstrable abrasion of the surface epithelium to permit of the passage of infective organisms. Trauma of any kind greatly facilitates invasion.

Treatment. *Prophylactic.* A consideration of the nature of the infective organisms, their portals of entry and their origin, will suggest many ways in which the septic infections of the new-born may be prevented. It will also explain the small number of cases that are now met with, since the introduction of antiseptic methods of treating both the mother and the infant, whether in private or institutional practice. Cleanly midwifery, isolation of the infants from potential sources of infection, respect for epithelial surfaces, breast feeding, and increased resistance in the infant by the avoidance of deficiency symptoms in the

mother during pregnancy, are all precautions which will promote the object in view.

Curative. Unfortunately the treatment of septic conditions in the new-born is exceedingly unsatisfactory, unless indeed the responsible organism can be identified and dealt with by specific serological measures. For this reason every effort should be made to discover by the bacteriological examination of the blood, urine, fæces, serous fluids, or mucous discharges, the exact nature of the offending organism. A positive finding from the blood is the most satisfactory diagnostic evidence of identity, for organisms discovered in the blood are usually in pure culture, but it requires a good deal of perseverance and determination to make repeated hæmatological examinations of this kind. Evidence derived from other sources is less satisfactory, but any positive findings of streptococci, especially of the hæmolytic variety, of staphylococci, of pneumococci, or meningococci, in urine, fæces, cerebrospinal fluid or discharges, should certainly encourage the administration of appropriate serological treatment. If the concentrated sera are employed these can be given without much inconvenience, even in the case of small babies, and the results are on the whole encouraging. In cases in which the identity of the organism cannot be discovered, the intravenous transfusion of grouped citrated blood is always worth trying, owing to its polyvalent protective properties, prontosil may be given by the mouth (see page 699).

Skin Diseases of the New-born

Owing to the soft and macerated condition of the skin at the time of birth, the new-born baby is subject to various inflammatory reactions of its epithelium and appendages. Further, in consequence of the considerable denuding of the superficial strata of the epidermis which takes place with the removal of the *vernix caseosa*, and owing to the absence of the horny layer which has not yet had time to develop, infective organisms can penetrate into the corium and sub-epithelial connective tissue and set up inflammations without there being any obvious cracks or abrasions.

The skin affections which occur at this period of life are :

1. Erythematous eruptions, erysipelas, gangrene, eczema, bullous eruptions, vesication, ulceration, desquamation, and papules.
2. Seborrhœa, and comedones.
3. Sweat rashes, and miliaria.
4. Onychia.

Treatment. The treatment of these skin conditions in the

new-born is practically the same as that in the case of older babies (see pages 455–529).

As regards preventive treatment, however, there are certain precautions which apply in the case of new-born infants, which have no relevance in the case of older babies, and these will be described here.

The main desiderata are as follows :

1. To prevent damage to the skin by rubbing, handling, or friction.
2. To keep the skin dry.
3. To promote keratinization of the horny layers.
4. To prevent infection.

Most of the damage inflicted on the skin immediately after birth occurs through over-zeal on the part of the nurse or midwife to remove the *vernix caseosa* by washing with soap and water, and in the subsequent drying of the skin by backward and forward rubbing with a towel, which is calculated to scrape off the superficial layers of epithelium. All washing should be done with the utmost gentleness, and drying should take the form of dabbing. The common practice of lubricating the whole of the skin with olive oil after the first bath has very little to commend it, since oil tends to soften the skin rather than to harden it, and all vegetable oils, such as olive oil, are decomposable, while the resulting fatty acids are irritating to the skin. From the latter point of view, liquid petroleum is preferable since it cannot undergo decomposition changes, but in my opinion it is better not to oil the skin at all, except the buttocks and neighbouring parts, which are liable to become contaminated with fæcal matter, which is difficult to remove, and the oil may perhaps prevent this from adhering too closely to the skin.

In drying the skin, care must be taken to remove all moisture, and especially soap, from behind the ears, and folds in the skin. After drying, the whole body, with the exception of the scalp, should be freely dusted with a fine talc powder, so that the skin may be kept perfectly dry and protected from friction. There is little ground for the belief commonly held that dusting powders block up the pores of the skin and lead to the production of comedones or blackheads : if that were so, all modern females would have a rich crop of them, not only on their faces but also all over their bodies. Personally, I do not advise a repetition of the first bath until the cord has dropped off and the skin has had time to harden.

The skin of the buttocks and other parts which are particularly liable to damage and irritation, may be very satisfactorily hardened

by the application of tannic acid dissolved in alcohol (1 in 8). The skin should be sponged with this solution once or twice a day, and allowed to dry before the application of dusting powder and the napkin.

As regards the prevention of infection, this is most liable to occur at the umbilicus and at the exposed parts of the skin—the scalp, and fingers. In the general handling and management of a baby all antiseptic and aseptic precautions should be taken to prevent pathogenic organisms coming into contact with the skin.

Abnormalities in the Urine of the New-born

Albuminuria. The presence of a small quantity of albumen in the urine of new-born babies is not to be regarded as of pathological significance. A little oozing sometimes takes place from the blood capillaries, owing to the initial permeability of the epithelium of the glomerulæ and renal tubules. A few casts and epithelial cells and even sometimes a few stray blood corpuscles are also found in the urine. If any of these abnormal constituents persist in the urine after the first few days of life, syphilis or sepsis may be suspected, and in the latter case there will also be a bacilluria.

Uric Acid. Uric acid is nearly always present in excess in the urine of new-born babies. It sometimes imparts a pinkish coloration to the napkin—the so-called " cayenne pepper " stain. One of the results of uric acid irritation is said to be the presence of albumen in the urine. I have on more than one occasion seen, in male babies, obstruction of the passage of urine by a concretion of amorphous urates in the urethra. Such an obstruction can be easily removed by the passage of a soft catheter.

Treatment. *Prophylactic.* Since the chief cause of uric acid crystals and concretions is a too concentrated condition of the urine, precautions should be taken to ensure that the infant obtains sufficient fluid during the colostrum period, and indeed afterwards, by the giving of additional water if such should be required.

Curative. The treatment is to give 5 grains of citrate of soda, or better, citrate of soda combined with citrate of potash, three or four times a day in $\frac{1}{2}$ oz. of water.

CHAPTER VII

THE ALIMENTARY SYSTEM

Tongue-Tie

This is the name given to that condition in which the *frænum linguæ* extends to the tip of the tongue, and is supposed to interfere with sucking, and later with talking, owing to the fact that it holds the tongue down to the floor of the mouth, and prevents its projection. As a matter of fact these difficulties result not so much because the frænum interferes with the movements of the tongue, as that the movements of the tongue are imperfectly controlled by the nerve mechanisms concerned. If owing to nervous inco-ordination the tongue cannot be properly projected from the mouth, or otherwise freely moved, as occurs in certain degenerate types of infant, the frænum remains unstretched, and appears to be holding down the tongue to an undue extent. In such circumstances it is clear that snipping the frænum will not greatly improve the motor functions of the tongue. Cases have been reported in which surgical interference of this kind has rendered the tongue too mobile, thus allowing it to fall back in the mouth and to such an extent as to interfere with breathing. For this reason, before snipping the frænum in cases of so-called "tongue-tie," the question should be very carefully considered as to whether such an operation is justifiable.

Lip-Tie

This is a somewhat similar condition, due to an abnormally short frænum of the upper or lower lip. The frænum in such cases may interfere with the mobility of the upper lip, or it may lead to disfigurement, as it may predispose to a separation of the upper central incisor teeth, and prevent the upper and lower lips from meeting. Under such circumstances incision of the frænum is justifiable.

Ranula

This is a reddish swelling under the tongue, due to the presence of a retention cyst of the sub-lingual salivary gland. It may

interfere with sucking, and other movements of the tongue. This condition calls for surgical interference.

Stomatitis

Many varieties of stomatitis or inflammation of the mouth occur in infancy. Some are symptomatic of, or sequelæ to some special infection such as diphtheria, syphilis, measles, whooping-cough, etc., and must receive specific treatment suitable to these conditions, while other forms occur in infantile scurvy, during dentition, and in thrush. The inflammation may be of a catarrhal, aphthous, ulcerative, herpetic, hæmorrhagic, or even gangrenous character.

The treatment of all forms excepting those which occur in thrush, dentition, and scurvy, is practically the same, namely, by the local application of an antiseptic mouth wash (see page 704), but each of the above exceptions requires special description.

Thrush. Thrush is due to the development in the mouth of a special variety of Monilia. The exact classification has not yet been determined—hitherto it has been known as Oïdium Albicans or Saccharomyces Albicans. This mould grows very readily on the mucous membrane of the mouth, especially when the latter has been damaged by mechanical means, such as by frequent washing out of the mouth with pieces of rag, by thumb-sucking, the use of the dummy, or even by prolonged sucking at the bottle or breast. Contrary to what is generally believed, the thrush mould grows better in an alkaline than in an acid condition of the mouth. At the Infants Hospital the old method of treating thrush by wiping out the mouth with glycerine of borax has been entirely superseded by one in which a solution of Monsol (1 in 400) is used instead. Monsol appears to have what is practically a specific action on this species of Monilia.

Dentition (Stomatitis). It is questionable whether this subject is more appropriately included in this chapter which deals with diseases of the digestive system, or in that which is concerned with the nervous system, since most of the symptoms connected with dentition can be referred to some disturbance of the latter. During both primary and secondary dentition there is often a good deal of inflammation of the gums owing to the tension caused by the erupting teeth. Either reflexly, or by irradiation, a considerable disturbance of the nervous system results, which may be reflected in almost any direction, and manifested most acutely in those nerve centres which are most unstable. This accounts for the great variety in the symptoms which may occur during dentition. In addition to the

actual inflammation of the gums or stomatitis, there is usually considerable salivation owing to reflex stimulation of the salivary glands. Similarly, there may be some increased secretion from the mucous membrane of the nose, a disturbance which is often erroneously regarded as a simple cold in the head. There may also be lacrymation, or even ulceration of the cornea. Perhaps the most common symptom of all is the dilatation of the capillaries of the cheek due to a vaso-motor reflex. Pimples on the chin are by no means uncommon, and so is eczema behind the ear. All these symptoms represent local reflex disturbances, but the effects of dentition may be of a more distal and widespread character. General convulsions are by no means uncommon, and disturbances in the vomiting centre are of frequent occurrence, while symptoms of diarrhœa or constipation, representing disturbances of other nerve centres often occur in specially predisposed infants.

Infants who have previously suffered from bronchitis, pneumonia, asthma, or other troubles of the respiratory system will often repeat the symptoms peculiar to these conditions with the eruption of successive teeth. There are practically no symptoms which cannot be produced or reproduced during the period of dentition provided the predisposition exists.

Treatment. The local treatment of that form of stomatitis which is the direct result of teething is the same as that which is applicable in other varieties of stomatitis, but the indications for the treatment of the secondary nervous symptoms are to reduce the excitability of the central nervous system by every available means. One cause of increased nervous excitability is a low calcium content of the blood—a condition which is generally known as spasmophilia. The treatment for this is to give vitamin D, calcium lactate, and alkaline salts (see page 696). The bromides also help to reduce the excitability. The formula for combining these drugs is given on page 690, under the name of mistura dentalis. Phosphorus dissolved in cod-liver oil (page 699) is a very old and valuable remedy for spasmophilic conditions ; it is particularly useful in cases of difficult dentition. As a purely local treatment rubbing the gums with orange-juice is strongly advised, and in cases in which the gums are very hard, congested, or hæmorrhagic, incision with a scalpel often gives instantaneous relief.

Infantile Scurvy (Stomatitis). The hæmorrhagic form of stomatitis which occurs in infants suffering from infantile scurvy is only found in babies after the eruption of the milk teeth. It is very easily cured by the administration of orange-juice, or

other concentrate of vitamin C, or ascorbic acid, and has already been referred to in the paragraph which deals with infantile scurvy (page 94).

Bednar's Ulcers (Ulcera Pterygoidea). These are aphthous ulcers of the mucous membrane of the roof of the mouth at the junction of the hard and soft palate, usually due to mechanical injury by pressure on the mucous membrane which overlies the hard bony prominences of the pterygoid portion of the sphenoid bone, caused by over-zealous swabbing out of the mouth after feeds, or by the sucking of dummies. These ulcers sometimes form the starting-point of thrush, which may spread widely over the entire mouth.

The treatment consists in removing the cause, and painting the ulcers with a 2 per cent solution of nitrate of silver.

Congenital Cysts, Pouches, and other Abnormalities in the Development of the Œsophagus

The œsophagus may be absent, double, completely occluded, or communicate directly with the trachea. These conditions are hardly compatible with life, and no treatment can be attempted.

On the other hand, cases of partial atresia due to a membranous diaphragm or to localized narrowing of the œsophageal wall, are not necessarily fatal, though the treatment is troublesome.

Congenital pouches or retention cysts are sometimes met with in the upper and anterior aspect of the œsophagus. Lateral pouches, also in the upper half, and possibly associated with incomplete closure of the 3rd or 4th branchial cleft, are likewise of occasional occurrence.

The diagnosis of all these conditions depends partly on œsophagoscopy, and partly on X-ray examination, combined with a solid opaque meal—*i.e.* bismuth biscuit, for children who can masticate, or with a liquid feed for those who cannot.

The symptoms are vomiting when solid food is taken, and occasionally the appearance of a fluctuating swelling in the neck, due to the filling up of an open pouch with milk or other fluid.

Treatment. Surgical treatment of these cases is seldom satisfactory, and even the passage of bougies is not always attended with better results than those which follow patient adherence to a fluid dietary.

Gastritis

Gastritis as an independent disease, and unassociated with enteritis is very rare in infancy, and by no means common in

early childhood. Acute attacks of vomiting from various causes, as for instance, from sepsis, influenza, improper feeding, or breakdown of liver function, are often ascribed to gastritis, although beyond the vomiting there may be no evidence of inflammation of the gastric mucosa.

Acute Gastritis. This may be of a catarrhal, ulcerative, or membranous character. The first mentioned is much the most common, while the membranous form is very rare, and the ulcerative extremely serious and seldom met with. The most diagnostic symptoms of acute gastritis are vomiting, thirst, and a red or glazed tongue. There is usually also some degree of pyrexia, loss of appetite, and unpleasant breath. The vomitus will differ in accordance with the food taken, but it generally contains a considerable amount of stringy mucus, and sometimes blood, pus cells, streptococci, or other forms of bacteria. The reaction may be strongly acid, though it is occasionally alkaline.

Treatment. The main indications for treatment are—

1. To give the stomach complete rest.
2. To compensate for the dehydration due to vomiting.
3. To allay pain and nervous irritability.

To ensure these ends all feeding by the mouth should be temporarily suspended. Fluid should be introduced into the system by a subcutaneous injection of glucose saline (pages 714 and 717), or by enema. The stomach should be washed out once or twice daily with a 1 per cent solution of bicarbonate of soda.

Treatment by Drugs. Drugs are not well retained in the stomach in cases of gastritis, neither are they well absorbed. It is probably better to rely on hypodermic administrations. Morphia is the most reliable of all drugs in such cases. It must however be given very carefully lest there should be susceptibility to its influence. Not more than $\frac{1}{100}$ of a grain should be given at first, although the dosage may be increased if the results are satisfactory. Bismuth in the form of Glycerinum Bismuthi Carbonatis (page 691), is better tolerated by the stomach than almost any other drug, and if retained it sometimes affords relief owing to its soothing qualities.

Chronic Gastritis. This condition, like acute gastritis, is seldom found in babies, or young children, as an independent disease. It is nearly always associated with chronic inflammation of other parts of the intestinal tract (gastro-enteritis), or it is combined with gastric dilatation. Chronic gastritis may follow an acute attack, or commence in the sub-acute form. In babies the inflammation is generally caused by improper feeding, and by the fermentation of food which escapes normal digestion in

the stomach by reason of excess in quantity or unsuitability in quality. The symptoms are vomiting, furred tongue, with wind or flatulence, and the belching up of unpleasant-smelling wind. Examination of the vomitus may disclose the presence of mucus, pus cells, blood, hyperacidity or undigested food.

Treatment. The indications are to give only those varieties of food which are easily and readily digested by the gastric fluid. Starvation, which would, under other conditions, be the most effective means of restoring the stomach to health, cannot be enforced owing to the chronic character of the inflammation. The best form of food to give is undoubtedly peptonized milk (page 709), supplemented with bone and vegetable broth (page 708). Although fruit and sweets are generally interdicted, in my experience they are well tolerated in the form of orange juice or grape-juice, sweetened with glucose and diluted with water. These may be given in quite large amounts, alternating with the milk feeds, but at well-spaced-out intervals. Fluids of this character ought to wash out the stomach and remove mucus, but these ends may be furthered by lavage of the stomach with 1 per cent solution of bicarbonate of soda. Plain drinks of hot water will have the same result.

Drugs. The drugs that are of most value in these cases are bismuth in the form of Glycerinum Bismuthi Carbonatis (page 691), citrate of soda, and citrate of potassium. If there is associated constipation, Milk of Magnesia (page 695) with or without Petroleum Emulsion (page 693), can be given in addition. In those cases in which the chronic gastritis is associated with hypochlorhydria, a complication which can be diagnosed by the submission of the stomach washings-out to chemical analysis, the case must be treated by acid rather than alkaline therapy, and the milk should be peptonized by pepsin and hydrochloric acid (page 691), instead of by pancreatic preparations, while bismuth subnitrate may be substituted for the bismuth carbonatis.

Dilatation of the Stomach. The chief causes of gastric dilatation are repeated distension from over-feeding, and chronic catarrh due to improper feeding. The most extreme instance of dilatation I have ever met with was in a new-born baby who vomited 9 oz. of liquor amnii immediately after birth. The immense capacity of the stomach was confirmed by repeated stomach washing during the few days the infant lived. This case may quite rightly be regarded as one of congenital origin, due to the habitual swallowing and vomiting of amniotic fluid before birth, but it also indicates the facility with which the development of the organ can be modified by its early experiences,

and indicates that with the same degree of provocation, the younger the baby, the greater the dilatation.

General dilatation of the whole of the alimentary tract including the stomach is liable to result from a deficiency of vitamin B. I therefore regard it as a prophylactic measure of value in the prevention of gastric dilatation to ensure an adequate supply of this vitamin during the early days of life, and I invariably give all artificially fed babies vitamin B in the form of Yestamin (page 708), or some other yeast preparation with their food. Since doing so I am convinced that babies so treated have had less voluminous intestines, and stomachs of better tone. The degree of dilatation can be accurately gauged by measuring the amount of water which the stomach will retain when lavage is employed, or by means of X-rays after an opaque meal. The actual outline of the stomach can often be made out in babies with thin abdominal walls by visual inspection.

Treatment. This consists in restricting the volume of the feeds, and in ensuring that they are of such a nature as to be easily digested in the stomach. Since casein curds are very refractory to gastric digestion and are retained in the stomach, until they are rendered completely soluble, infants suffering from gastric dilatation should not be fed with milk of any variety which can form heavy clots in the stomach. It may however be given in the form of peptonized milk (page 709), lactic acid milk (page 44), or citrated milk (page 45), according to the special indications. In order that the volume of the feeds may be restricted as far as possible, in whatever form the milk is given, it should not be diluted with water. Light massage of the abdomen (tapotement), is sometimes of value in reducing the size, so also is electrical treatment.

Vomiting

Vomiting is essentially a protective reflex, protective in the sense that it saves the individual from the consequences of retaining food in the stomach which under existing circumstances might be unsuitable, either by reason of its quality or its quantity. Thus poisonous or irritating substances are rejected soon after being swallowed, and the same result follows when the stomach itself is in an irritable or inflamed condition and requires rest. Vomiting may also occur as an associated reflex with enteritis or other disturbances of the bowel, and in those pathological states in which the consumption of food is contra-indicated. It will also occur in dilatation of the stomach (see page 175), or in so-called pyloric stenosis. Emesis is also a symptom of obstruc-

tion in the bowel, such as volvulus, intussusception, strangulated hernia, peritoneal adhesions, or persistent Meckel's diverticulum. Vomiting also results from direct stimulation of the vomiting centre in the medulla, by substances circulating in the blood such as apomorphine, emetine, and antimonial preparations administered for therapeutic purposes, by toxins of bacterial origin generated in the system, or, as in uræmia, by the toxic products of abnormal metabolism. It is also occasionally a prodromal symptom in acute affections, such as scarlet fever, or diphtheria. Direct stimulation of the vomiting centre by high blood temperatures, or by excessive intracranial pressure, as in meningitis, cerebral tumours, or hydrocephalus, is also a cause of vomiting.

Further, vomiting can occur in infants as a result of the establishment of a perverted or conditioned reflex persisting long after the cause which originally provoked it has ceased to operate. Habit vomiting is one of the commonest varieties of emesis in infancy, and can take several forms—one known as rumination has definitely a voluntary element in it.

In treating cases of vomiting in infants or young children, the first essential is to diagnose the cause, and then to concentrate on the cause rather than on the symptom. It would obviously be impossible to give a separate account of the treatment of every variety of vomiting; four typical varieties will be described here with detailed directions of the measures to be employed in each.

Acute Vomiting from Food Causes.

Vomiting is extremely likely to occur in infants if by reason of the insoluble nature of the food, or owing to excess in quantity, the stomach contents are not properly digested. Under such circumstances vomiting occurs owing to retention, and concomitant irritation of the gastric mucosa, in other words by the calling into play of a protective reflex. In artificially fed infants the most common cause of vomiting of this kind is the giving of unsuitable preparations of cow's milk, or by the swallowing of air owing to defects in the nipple; and in breast-fed infants by allowing them to take too much at a feed, or to take too long over a feed. In older children vomiting is generally due to the taking of unduly large and rich meals under circumstances in which they are unlikely to be digested.

In all cases of vomiting it is essential to examine the vomitus to discover a clue as to the cause. In infants undigested coagula or casein may be discovered, and in older children large pieces of unmasticated food. Extreme degrees of acidity (hyperchlorhydria) of the gastric contents may cause vomiting, and the same result may follow when it is not acid enough (hypochlorhydria).

The treatment of acute cases of this kind is temporary suspension of all food in order to give the stomach an opportunity of recovery. As a rule 12 hours is sufficient. After that time normal feeding may be gradually resumed. In the case of infants, if the vomiting is due to undigested casein it is obvious that precautions must be taken to prevent a repetition of the cause, by giving milk in a form in which it can no longer coagulate in the stomach. This can be done by giving—1. Peptonized milk (see page 709); 2. Lactic acid milk (see page 44); 3. Citrated milk (see page 45).

Peptonized Milk. This is always a safe remedy and the time of peptonization may be gradually reducedto zero as improvement occurs.

Lactic Acid Milk is indicated in cases in which the vomitus is only faintly acid (hypochlorhydria) or actually alkaline.

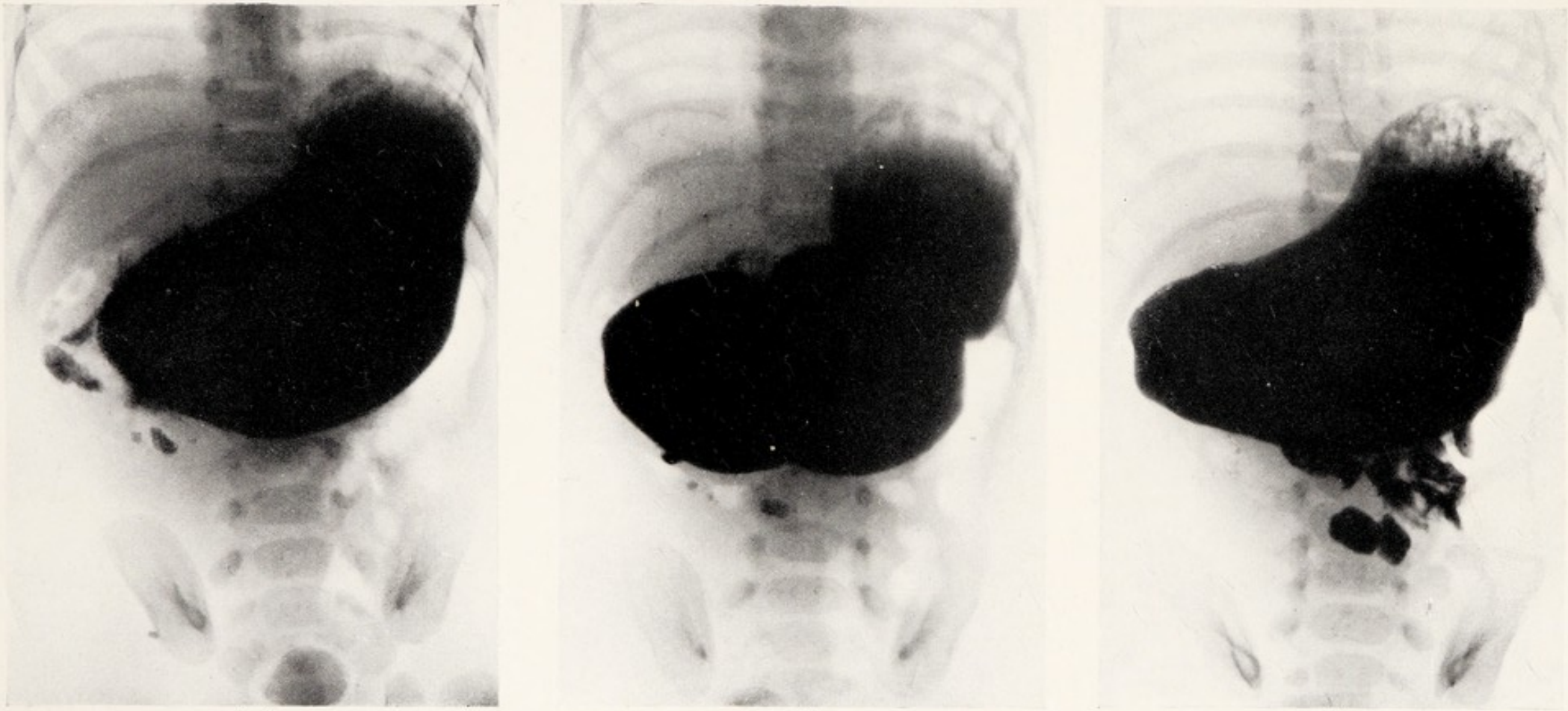
Citrated Milk may be used when the stomach contents are hyper-acid (hyperchlorhydria).

Drug Treatment. As a rule in acute and short-lived attacks of vomiting drugs are unnecessary, although it is generally safe to give a mild aperient, such as milk of magnesia, or syrup of figs. Bismuth in the form of Glycerinum Bismuthi Carbonatis (page 692) may be given if the gastric mucosa is in an irritable condition. Bicarbonate of soda may be given in cases of hyperchlorhydria, and dilute hydrochloric acid in cases of hypochlorhydria.

Congenital Hypertrophic Pyloric Stenosis.

Custom has sanctioned the application of this somewhat verbose title to that common form of vomiting in young infants which is due to obstruction at the pyloric orifice. It is however a most unfortunate and misleading title, for in the first instance these cases are very rarely congenital—the symptom is practically always acquired, and the result of bad feeding—and in the second place there is no stenosis. Moreover, hypertrophy of the muscular sphincter is not an essential or indeed an important element in the condition, but merely the result of over-action.

The obstruction at the pylorus does not depend on any organic stenosis or narrowing of the pyloric orifice. The obstruction which is complete while it lasts is due to spasm, or at least to want of relaxation of the sphincter muscle. Sphincters such as those of the pylorus, anus, or mouth, are either in a condition of tonus or relaxation, that is to say, they are either shut or open, they are never in a half-way position or in a condition of stenosis. In the normal state they are closed and in a condition of mild



(*a*) (*b*) (*c*)

FIG. 16.—Stomach of Infant with pyloric obstruction (Dr. Bertram Shires).
(*a*) One hour after opaque meal; (*b*) one and a half hours after opaque meal; (*c*) two hours after opaque meal.

tonus. The active phase is one of relaxation, and therefore when a sphincter like that of the pylorus remains more or less permanently closed it is due to failure of those nerve impulses which normally determine its relaxation. In these cases, to which the name "Congenital Hypertrophic Pyloric Stenosis" is given, the sphincter is in a condition of hypertonus, which the normal action of the vagus nerve is unable to inhibit.

So-called pyloric stenosis is really habit spasm of the sphincter, a perverted or conditioned reflex acquired usually by over-action of the neuro-muscular mechanism concerned. This habit is very easily acquired during the early days of life (or more easily still during the ante-natal period by the swallowing of excessive quantities of *liquor amnii*), and it is usually caused by giving the baby cow's milk or other variety of food which is beyond its powers of digestion, that is to say by bringing the protective mechanisms into play.

Out of the large number of cases of this kind which have come under my notice, I have been able to elicit a history of improper feeding in more than 90 per cent. Many of them have been breast-fed infants in whom the cause has been excess of breast milk at the time of the establishment of lactation—a very likely danger, on the 3rd or 4th day of life. In the case of the artificially fed babies the reason has nearly always been that some form of cow's milk has been given which has coagulated in the stomach and formed too heavy a clot.

Diagnosis. The diagnosis of pyloric obstruction due to failure of the sphincter to relax is comparatively easy. The classical symptoms are projectile vomiting, visible peristalsis, a palpable pyloric tumour, and constipation, but in my opinion the diagnostic value of these signs and symptoms is not to be compared to the evidences of the bismuth or barium feed. The X-ray picture is definitely characteristic (see Fig. 16, Plate III), showing generally a large stomach which remains unemptied for several hours after the taking of a feed, as long as the observation lasts, or until vomiting relieves the pain and discomfort. During the whole of this period no portion of the opaque meal passes into the intestines, proving that the pyloric orifice remains persistently closed—not stenosed.

If, as occasionally happens, a picture is got at the moment of relaxation of the sphincter, it will be noticed that the shadow of the bismuth stream is of normal size as it passes through the supposedly stenosed orifice.

The second diagnostic measure of real value in these cases is to syphon off all the contents of the stomach some 3 hours after it has been consumed and to examine its character and amount.

In cases of genuine pyloric obstruction the amount recovered by this means will represent the total amount of the feed consumed, or even more, in those cases in which part of a previous feed is also retained in the stomach. As a rule the contents are strongly acid, and often quite well digested. The presence of blood or mucus in the vomitus may have additional diagnostic value, as indicating inflammation due to the retention, or the effects of the violent vomiting. The size of the stomach can be accurately gauged by measuring in the process of washing out, the amount of water that it will contain.

Treatment. From the point of view of treatment it makes very little difference whether the obstruction at the pylorus is actually due to organic or to functional causes, for the obstruction must be removed or the baby will die. In the great majority of cases the obstruction may be removed by medical means, but if this proves impossible, surgical interference must be resorted to.

Medical Means. By the time the baby comes under observation it has usually become greatly dehydrated, and may be in a more or less collapsed condition. The first thing to do after the diagnosis has been established is to compensate for the dehydration by restoring fluid to the system by one of the following means :

1. The subcutaneous injection of saline solution (see page 715), or glucose saline (see page 717).
2. By the intravenous injection of saline solution (see page 715), or glucose saline (see page 718).
3. By rectal injection of normal saline, or glucose saline.

All feeding by way of the mouth should be suspended for 12 to 24 hours, and then step by step and extremely cautiously, small quantities of saline solution should be given by the mouth. If this is retained, glucose saline may be substituted for the water, and subsequently fat-free whey or a solution of Secwa (1 drachm to the ounce) may take the place of the latter. If this stage has been successfully attained, the next one should be to substitute very fully peptonized milk (see page 709) for the whey or Secwa solution, but still in very small quantities and with very gradual increments.

Up to this point the feeding should be at intervals of about an hour, and the total amount given at one feeding should not in any case or at any stage be more than 1 oz. Should there be no return of vomiting the intervals between feeds may be prolonged, and the amount at each feed increased until normal conditions of feeding are attained. During these proceedings a decision must

be made as to whether the stomach should be washed out or not. As a general rule it will be found unnecessary, but if this measure is resorted to it is important that the saline solution used for washing-out purposes should not contain bicarbonate of soda, as in all probability the system has already lost so much acid by repeated vomiting that there is a relative excess of the bicarbonate reserve in the blood, in other words, a condition of alkalosis, and under such circumstances the indication is to restore the depleted acid radicle in the form of sodium chloride, which may be added to the water used for washing out the stomach, to the extent of 2 per cent.

Drug Treatment. The indication is to relieve the spasm of the pyloric sphincter, and the drug most likely to accomplish this object is opium. This can be given most safely in the form of camphorated tincture of opium, a very weak preparation of opium. One drop of this may be given as an initial dose. If well tolerated, the dose may be repeated and increased every 3 or 4 hours. Other drugs that are occasionally useful are chloral hydrate, gr. 1 : bromide of potassium, gr. 3 : tincture of belladona, minim 1 : and luminal, gr. $\frac{1}{6}$. A combination of these drugs will sometimes succeed though individually they may fail.

Surgical Treatment. Failure of medical treatment is the indication for surgical interference. It is however very essential to make certain of the diagnosis before taking this step. I have known several cases in which Rammstedt's operation has been performed and proved unsuccessful, for the reason that although the vomiting was of the classical type it was as a matter of fact due to, and secondary to, some underlying cause, such as sepsis, which could not be benefited by the operation. A diagnosis of obstruction at the pyloric orifice requiring surgical interference, should not be made too confidently, unless the symptoms have come on during the first 3 weeks of life, unless there is constipation without temperature, and unless the radiological evidence and that of the gastric lavage is definitely conclusive. The one clear indication which justifies, nay, rather compels operation, is proof of an obstinate closure of the pyloric orifice, which refuses to yield to ordinary medical and dietetic means.

Preparation of the Infant for Operation. The main point to be aimed at before operation is to combat the dehydration which results from the persistent vomiting. This may be secured by subcutaneous, intravenous, or rectal injections of saline solution (see page 714). It usually takes some 24 hours to restore a sufficient quantity of fluid. If possible, between 20 and 30 oz. of fluid should be introduced by one or other of the above means.

The operation should not be undertaken if depression of the fontanelle and overriding of the cranial bones still proves the existence of dehydration. All feeding by the mouth should be suspended for 24 hours before the operation. The anæsthetic should be continuous nitrous oxide and oxygen.

Post-operative Treatment. This is essentially dietetic. The chief indication is to prevent diarrhœa or other disturbances arising in an intestinal tract which owing to persistent vomiting has been thrown out of action and is likely to be upset. Too much care cannot be taken to restore the intestinal functions slowly, by very gradually increasing the quantity of food given, and by ensuring that it should be of a very easily digested kind. It must be remembered that after operation, and with an open pyloric orifice, food will pass directly into the duodenum without preliminary digestion in the stomach. This means that practically the whole onus of digestion will be thrown on the intestinal and pancreatic functions, which may prove unequal to the strain. Experience shows very conclusively that breast feeding is a strong "point" in favour of a successful issue, and therefore in those cases in which a breast-fed infant is admitted to a nursing home or hospital for the purpose of a pyloric operation, the mother should be admitted with it, or other steps taken to ensure breast feeding or at least breast milk after the operation. The first feed after the operation should be given within 1 hour, and continued in accordance with the following schedule.

SCHEDULE FOR FEEDING

Feeding of Cases after a Pyloroplastic Operation

First 24 Hours.

Intervals : Two-hourly, total number of feeds 12.
Quantity : Beginning with 1 drachm at each feed, increase by 1 drachm at each successive feed, up to 1 oz.
Total quantity 8¼ oz.
Food : 5 per cent glucose solution.
Note : Feed by spoon.

Second 24 Hours.

Intervals : Still two-hourly, total number of feeds 12.
Quantity : 1 oz. at each feed.
Total quantity 12 oz.
Food : ½ oz. Breast milk (expressed)
½ oz. 5 per cent glucose solution
or ½ oz. Cow's milk (peptonized 2½ hours)
½ oz. 5 per cent glucose solution
or 1 drachm (by weight) Secwa in 1 oz. water.
Note : Feed by spoon.

THIRD 24 HOURS.

Intervals : Still two-hourly, total number of feeds 12.
Quantity : 1¼ oz. at each feed.
Total quantity 15 oz.
Food : 1 oz. Breast milk (expressed)
¼ oz. 5 per cent glucose solution
or 1 oz. Cow's milk (peptonized 2 hours)
2 drachms 5 per cent glucose solution
or 1¼ drachms Secwa in 1¼ oz. water.
Note : Feed by bottle.

FOURTH 24 HOURS.

Intervals : Three-hourly, total number of feeds 8.
Quantity : 2 oz. at each feed.
Total quantity 16 oz.
Food : 2 oz. Breast milk (checked by Test Feed).
or 1 oz. Cow's milk (peptonized 1½ hours)
1 oz. 5 per cent glucose solution
or 2 drachms Secwa in 2 oz. water.
Note : Breast feeding direct from breast.
Artificial feeding by bottle.

FIFTH 24 HOURS.

Intervals : Still three-hourly, total number of feeds 8.
Quantity : 2 oz. at each feed.
Total quantity 16 oz.
Food : 2 oz. Breast milk (checked by Test Feed).
or 1½ oz. Cow's milk (peptonized 1 hour)
½ oz. 5 per cent glucose solution
or 1½ drachms Secwa with
½ drachm Cow and Gate dried milk in 2 oz. water
Note : Breast-feeding direct from breast.
Artificial feeding by bottle.

SIXTH 24 HOURS.

Intervals : Still three-hourly, total number of feeds 8.
Quantity : 2 oz. at each feed.
Total quantity 16 oz.
Food : 2 oz. Breast milk (checked by Test Feed).
or 2 oz. Cow's milk mixture humanized to breast standard (page 39), and peptonized ½ hour.
or 1 drachm Secwa with
1 drachm Cow and Gate dried milk in 2 oz. water with
1 grain of citrate of soda

SEVENTH 24 HOURS.

Intervals : Feed at 6 a.m., 9 a.m., 12 midday, 3 p.m., 6 p.m. and 10 p.m.
Total number of feeds 6.
Quantity : 3 oz. at each feed.
Total quantity 18 oz.
Food : 3 oz. Breast milk (checked by Test Feed).
or 3 oz. Cow's milk modified to breast standard (page 39), with
2 grains Citrate of Soda

SEVENTH 24 HOURS (*continued*).

Food : *or* 3 drachms of humanized dried milk (Trufood, *or* Cow and Gate, *or* Ambrosia) with
3 oz. water and
2 grains of Citrate of Soda

EIGHTH 24 HOURS : AND AFTERWARDS.

Gradually increase quantity of food up to normal for age and weight. It is very important that no sudden changes should be made as regards quantity or intervals of feeding ; time should be allowed for the digestive functions to settle down and accommodate themselves to the new conditions after operation. If, as indicated by the stools, and other conditions, the changes are too rapid, the rate of progress must be slowed down.

If constipation supervenes there is no need for panicky treatment. It is a good sign rather than otherwise. But if after a few days the motions are hard or infrequent, small doses of Petroleum Emulsion (see page 693) may be given.

Habit Vomiting.

If the views which have been expressed in the foregoing paragraphs in connection with the causation of vomiting in so-called congenital hypertrophic pyloric stenosis are correct, why should it not be included among the other varieties of habit vomiting which are described in this section ? The reason is that there is so universal a belief that this variety of vomiting is due to an organic stenosis of the pyloric sphincter that no one would expect to find an account of it among descriptions of purely functional disorders. Moreover, the treatment of cases of vomiting due to pyloric obstruction is of a very special kind, and deserves a section, if not a chapter, to itself.

Habit sickness in babies includes varieties of every degree of severity, from slight regurgitation to the most violent forms of projectile vomiting, in which practically all the gastric contents are expelled. Regurgitation, or posseting, as it is sometimes called, represents as a rule little more than the expulsion from an over-filled stomach of the excess of food. Like all other functional habits, it is due to the establishment of a perverted or conditioned reflex. In regurgitation the habit consists in sudden relaxation of the cardiac sphincter at the precise moment when the gastric pressure is at a maximum owing to sudden contraction of its intrinsic musculature. It differs essentially from projectile vomiting in that the latter is dependent on contractions of the diaphragm and abdominal muscles. Projectile vomiting, whether habitual or not, only represents a modified form of expiratory effort in which the glottis is kept closed and the cardiac orifice of the stomach is suddenly relaxed. This complicated reflex,

like the other reflexes concerned in hiccoughing, coughing, sneezing, and belching, can very easily become a fixed and intractable habit, especially if it is repeated sufficiently often and at a sufficiently early age.

Regurgitation. Regurgitation is often regarded as a natural and physiological reflex which provides against over-filling of the stomach, and as such requires no treatment, but in my opinion it should be regarded as a tiresome and objectionable habit, which gives a good deal of needless trouble to the nurse who looks after the baby.

A more serious form of habit vomiting is that in which a large proportion of the stomach contents is expelled at variable times after the taking of food, sometimes immediately, sometimes later, and sometimes repeated several times before the time of the next feed.

The degree of seriousness with which vomiting of this kind should be regarded depends largely on the total amount of food which is retained. If sufficient of it is rejected to prevent the baby gaining weight, or results in bringing about an actual loss, it must be regarded as serious, even though the vomiting is purely functional and due to habit.

Before vomiting can be classified as habitual, great care must be taken to exclude cases due to some underlying pathological condition, such as gastritis, enteritis, obstruction, renal disease, or cerebral irritation.

If in spite of continuous vomiting and loss of food the infant looks well and continues to gain in weight, the vomiting cannot be due to any serious organic cause. A bismuth meal and X-ray examination is the most effective means of clinching the diagnosis. In habit vomiting, it will generally be found that the stomach empties itself rapidly through both the pyloric and cardiac orifices, thus distinguishing itself from vomiting due to pyloric obstruction.

Rumination. This type of habit vomiting is a very persistent one, and often gives cause for considerable anxiety : it is partially voluntary, indeed the infant appears to take considerable pleasure in rejecting feeds, and finds great satisfaction if the attempt succeeds. If the infant is old enough to do so, it will sit up, roll about, or make other attempts to empty the stomach by calling the abdominal muscles into play. It will put its fist into its mouth and keep up a series of rhythmical tongue-and-lip movements, which by a sort of reverse action conduces to a return flow of the liquids or food swallowed. I have known several cases in which even in the case of quite young babies the nurse

has been able to control these voluntary antics by severe scoldings and other disciplinary measures.

Treatment. When once a definite diagnosis of habit vomiting has been established, treatment becomes quite easy. The indication is to make it as difficult as possible for the infant to empty its stomach after taking food. The more liquid the food and the larger the quantity, the easier does it become for the infant to effect the vomiting, and conversely, the smaller the feed and the thicker its consistency, the more difficult is it to get rid of the food. The principle of thickening the feed has often been applied in cases of habit vomiting with varying success. As a rule it fails because the medium employed is usually some form of starch, which if retained is a very unsuitable form of food for young infants. For many years past I have adopted a much simpler method, and that is to give condensed milk without any dilution. The quantity of this " thick " food which is required to fulfil the caloric requirements is so small that it is practically impossible for the infant to reject it by vomiting. Moreover, unlike starch, it is easily digested by the youngest infant. Each feed should be given in a teaspoon, from which the infant very readily licks it. As regards quantity, the physiological allowance can be calculated on the following basis :

The caloric allowance of 50 should be provided for every pound of body-weight ; the caloric value of ordinary sweetened condensed milk (Nestlé's) is 100 per oz. Therefore, a baby weighing 10 lb. will require food of the value of 500 Calories in the 24 hours, *i.e.* 5 oz. of condensed milk. If the child is fed five times in the day each feed must consist of 1 oz. of condensed milk, and this amount must be measured by weighing on accurate scales. Since a whole tin contains just about 14 oz. by weight of condensed milk, one tin should last nearly 3 days. By this means the accuracy of the measurements can be checked and confirmed.

When infants are fed in this way the tins of condensed milk should not be opened and their contents poured into a basin, a proceeding which must obviously lead to the contamination of the milk, but rather, two holes should be punched in the lid and the milk freshly taken from the tin by pouring it into a spoon through one of the holes. In the intervals, the tin should be covered with a wet cloth and kept in a cool place.

Sufficient water to supply the fluid needs of the baby should be given independently 2½ hours after the " dry " feed, and to this may be added orange-juice, or any other accessory which it may be thought desirable to give the baby in addition to the milk. As a rule the infant will vomit part of the water, or some-

times the whole of it, but he will retain the milk. This method may be employed for infants of any age over 6 weeks. It is seldom necessary to employ it before that age.

It is obvious that this method has no application in the case of definite pyloric spasm or obstruction. Thickened feeds of this kind are more likely to aggravate than relieve pyloric spasm.

Cyclic Vomiting.

By cyclic vomiting is usually understood recurrent attacks of severe vomiting with prostration, loss of weight, pyrexia, acidosis, and ketosis. The attacks usually succeed one another with singular regularity at intervals which vary from a week to a month, or even to 2 or 3 months. They start suddenly and come to an abrupt termination. As a rule they do not occur in children under 2 years of age, and are most common between 5 and 8 years. They are sometimes anticipated in children under 4 years of age by night terrors, which are common up to that age, and are often replaced by attacks of migraine, when the children are over 12 years of age. Sporadic attacks are often called acidosis —a misnomer—for vomiting is not a symptom of acidosis, and acidosis when it occurs conjointly with cyclic vomiting is not an essential element of the attack.

There seems to be of recent years a general change of opinion to the view that cyclic vomiting is due to a breakdown of liver function. Personally, I do not regard these attacks as primarily due to derangement of liver function, but rather that derangements of liver function are very liable to precipitate the attacks. The view that I take of cyclic vomiting is that it is essentially a disturbance of the vomiting centre itself in the medulla, somewhat of the same nature as migraine, or epilepsy, in which cortical centres are involved. There may be, and usually is, a general condition of instability of the whole of the central nervous system in children who are liable to these attacks ; moreover, such children are almost invariably neurotic, allergic, excitable, or psychopathic, and the attacks are consequently precipitated by emotional disturbances, excitements, parties, journeys, eye-strain, or other forms of excitement. I have often noticed that thunder-storms and east winds bring on an attack, in the same way that these meteorological events produce irritability and bad temper in adults. I mention these exciting and predisposing causes because they are frequently noticed to be factors in the etiology of cyclic vomiting, although as a rule no satisfactory explanation of the connection is forthcoming.

There is nothing peculiar in the vomiting centre taking on rhythmical habits of explosion. Such a result coincides with

what occurs in the case of other nerve centres, but there appears to me to be an additional reason why these attacks of vomiting should assume a regular periodicity, and this reason is as follows : in cases of cyclic vomiting there is nearly always evidence of some simultaneous breakdown in liver function. For instance, there may be a positive levulose test, also excess of urobilin and of acetone, both in the blood and in the urine. Although all these are well-recognized indications of liver failure the most important proof of all, in my opinion, is the unpleasant odour of the breath, which often precedes and sometimes accompanies the actual attack of cyclic vomiting. One of the chief functions of the liver is to detoxicate the various products of protein decompositions which are generated in the bowel. In cases of intestinal toxæmia such products are produced in great amount in the large intestine, and such of them as are diffusible or volatile are absorbed by the blood and are carried by the portal circulation to the liver, where they are, or should be, detoxicated or deodorized. Blood conditions naturally influence the degree of excitability, not only of the whole of the nervous system, but also of special parts which are prone to explosive disturbances. When, however from overwork the liver becomes exhausted and unable to maintain its normal standard of efficiency, these products of decomposition are set loose in the systemic circulation, where they play havoc with the functions of the nervous mechanisms. Such toxic bodies as are volatile are eliminated by the lungs and contaminate the expired air : others are eliminated in the urine.

The regularity in the sequence of these periodic breakdowns in liver function which precipitate the attacks of cyclic vomiting, are quite explicable on the ground that every individual liver has its own particular degree of tolerance. Each liver can continue to detoxicate so much poison, and no more, and for such and such a length of time and no longer. The breakdown then occurs, and Nature herself effects the cure by bringing about through stimulation of the vomiting centre an enforced period of starvation, with consequent cessation of the intestinal decompositions which are the *fons et origo mali.*

Treatment. The main indications for the prevention of attacks of cyclic vomiting are :

1. To protect the nervous system as a whole from all the fatigues and shocks which might possibly precipitate an explosive attack in any specially predisposed child. This includes the avoidance of those psychological factors and sources of excitement which are referred to in the preceding paragraphs.

2. To prevent the recurrence of those decompositions of food

in the bowel, which are specifically referred to in the section on intestinal intoxication (page 223).

Treatment of Attacks. Although the attacks themselves may be extremely alarming owing to the persistent character of the vomiting and the exhaustion and prostration to which they give rise, they are practically never fatal, and are self-limiting, in that the vomiting and the enforced starvation afford the liver the necessary rest and opportunity for recovery.

Although there is usually a concomitant acidosis and ketosis neither of these is an essential element in the pathology, and do not as a rule demand special treatment unless air-hunger or an excess of acetone or ammonium nitrogen in the urine indicates that the acidosis or ketosis is severe. Treatment for these conditions is the free administration of bicarbonate of soda and glucose, by the mouth if it can be retained, or by subcutaneous injection or enema in those cases in which they are rejected by the stomach. During the attack the child should be kept absolutely quiet and no attempt should be made to give him any form of food except glucose until the attack has come to an end.

Acute Gastro-enteritis

Clinically and pathologically there are a great number of different types or varieties of gastro-enteritis—some mild, some serious and fulminating, some obviously infective, while in others the infective element is not obtrusive. Some cases assume the character of a dysentery, others that of cholera ; but whether the attack is called by the familiar name of " D and V " (diarrhœa and vomiting), summer diarrhœa, cholera infantum, ileo-colitis, or any other of the innumerable names which have been given to acute attacks of diarrhœa taking more or less an endemic form, they all present the common symptoms of vomiting, diarrhœa, dehydration, toxæmia, and collapse, and they all more or less run their course practically unaffected by any special line of treatment.

There is clearly no one specific cause of " D and V " in infants, and quite as clearly there is no specific cure. Diarrhœa and vomiting in infants are constitutional reactions to a great number of different disturbing factors, and not only those which directly affect the alimentary tract. Most of the symptoms are due to the action of infective organisms of some kind within the system, of a parenteral character, possibly in the blood. In young babies sepsis is a frequent cause, and so is the common cold. But apart from the actual virulence of the organism, the severity of the course which the complaint runs will depend very largely on other

factors in the environment of the child. For instance, prolonged bad feeding, continued exposure to high temperatures, or other unfavourable hygienic conditions will definitely increase the intensity of the attack, but although summer diarrhœa has no specific bacteriology, it is equally certain that there can be no summer diarrhœa without bacterial involvement. At the Infants Hospital, with each successive epidemic of " D and V," we usually succeed in identifying the particular organism concerned, whether enteral or parenteral, whether streptococcal, or the bacillus of Shiga, Flexner, Sonne, or Morgan, but unfortunately although we may be able to identify the offending organism we are no nearer a specific cure, although from time to time specific cures of a serological nature have been advertised.

Treatment. The treatment should be based on the supposition that the symptoms are an expression of a reaction of the organism to an acute infection, although there may be many other factors which determine the particular type which the disease assumes. In order to fight the infection, the strength of the child must be maintained, and his resistance must not be allowed to be sapped by the exhausting drain of diarrhœa or vomiting. First of all it is essential that all food by way of the mouth should be withheld for a time, or otherwise both the diarrhœa and the vomiting will be aggravated. On the other hand, owing to the dehydration, fluid must be restored to the body by some effective means. If plain boiled water or saline solution cannot be retained in the stomach, resort must be had to subcutaneous or intravenous injection of normal saline (page 717), or glucose saline (page 717).

Enemas of sterile water serve the double purpose of washing out the bowel and restoring fluid. Washing out the stomach with a 1 per cent solution of bicarbonate of soda or normal saline is sometimes of advantage in removing mucus or the residues of food, but it must be remembered that the stomach itself is by no means always involved, and the operation itself may be a cause of exhaustion.

Although the method of continuous intravenous injection of fluid has been strongly advocated in serious cases of " D and V," I cannot endorse from my own personal experiences the favourable views which have been expressed. The technique of the operation is too difficult and elaborate for general application, it involves too much immobilization of the child, and there are certain surgical risks.

Drug Treatment. Stimulant treatment is indicated in all cases. Brandy can usually be given by the mouth and may be added to the water or saline solution which the child takes by the mouth.

Camphor, coramine, or strychnine may be given hypodermically if the collapse is extreme. No drug, certainly no intestinal antiseptic has, as far as my experience goes, any specific action. Antiseptics are practically useless, even in cases in which the infection is of an enteral character. Of all drugs, morphia given hypodermically is the most valuable. It reduces restlessness and irritability and enables the child to obtain much needed sleep.

Specific Treatment. Even in these cases in which some predominating organism can be identified, little can be expected of specific serological treatment,[1] although blood transfusion, which offers some chance of reinforcing the resistance by reason of its *multi-valency*, is sometimes useful, so also is prontosil.

General Treatment. The blood temperature must be carefully watched. There are often great variations both above and below normal. With any high degree of pyrexia I have found phenacetin in small doses extremely useful. With low temperatures and collapse a hot mustard bath is invaluable, followed by the application of hot-water bottles, or an electric blanket (page 121). Every possible precaution should be taken to avoid disturbing the child by too frequent changing and washing, although steps should be taken to prevent soreness or excoriation of the buttocks by irritating evacuations. Sponging the skin in the area liable to be irritated, with an alcoholic solution of tannic acid (page 702) may harden the integuments and prevent soreness. Full provision should be made for fresh air and undisturbed sleep.

As regards feeding, it is always a questionable matter at what moment to begin feeding by the mouth. Provided that an ample amount of glucose saline has been supplied by the mouth, or by subcutaneous or intravenous injection, there is no great urgency to supply additional food by the mouth. If glucose saline taken by the mouth has been retained, whey, or sherry whey, is usually equally well tolerated. Veal broth is also well borne. It is sometimes recommended to give the water or other fluid as hot as can be borne, but personally I cannot agree with this, and believe that they are better given quite cold, or even iced.

Convalescence. The return to normal conditions is expedited by a careful supervision of the diet as soon as the acute symptoms have subsided. Since it is common experience to find during the acute and early stages that the acidity of the gastric contents is low and that there is no free hydrochloric acid in the stomach, acid must be given in some form or other, either as lactic acid milk (page 44), or in the form of a mixture of pepsin and hydro-

[1] Nebarro, D., and Signy, A. G., *Archives Dis. Childhood*, 1926, 1, 175.

chloric acid. As the digestive functions are restored there may be a gradual return to a normal diet, but it must be remembered that relapses are common and that it is easy for an acute attack to develop into a chronic enteritis. In those cases in which there is no hypochlorhydria, there is naturally no need to give supplementary doses of acid, and a bismuth mixture with pancreatic extract is better calculated to restore the digestive functions.

Diarrhœa and Loose Stools

Quite apart from the acute varieties of diarrhœa described in the preceding section, there are a considerable number of sub-acute and chronic forms of the complaint due to infective, dietetic, and other causes which deserve independent mention. First of all there are those severe varieties of colitis which are respectively described as mucous, ulcerative, and membranous colitis, and then there is that special variety known as cœliac disease. There are also varieties which are sometimes classified as protein, carbohydrate, and fat dyspepsias, and another multi-valent form of food diarrhœa known as lienteric diarrhœa. Yet another variety is due to habit, and is very common in young infants, and finally there is that form of diarrhœa which is found in association with intestinal intoxication. Each of these varieties requires its own specific treatment in accordance with the etiology.

Colitis.

Although colitis can assume acute, sub-acute, or chronic forms, only the two latter will here be described, for in its acute form it may be regarded as being included among the forms of acute gastro-enteritis. The sub-acute and chronic varieties are sometimes distinguished as catarrhal, ulcerative, or membranous colitis. Whether it is justifiable to draw such distinctions or not I am not prepared to say, but I propose to regard them as varieties of a single group, and as such they are described in the following paragraphs.

The common characteristic of all forms of sub-acute or chronic colitis is the presence of a great excess of mucus in the stools, which may be glairy, blood-stained, inspissated, purulent, or moulded into definite casts of the bowel. Fine inspissated threads are often mistaken for thread worms, while membranous casts have before now been diagnosed as segments of tapeworm. Such mistakes can be avoided and the exact character of the mucus determined by washing the stools in a large amount of water, and teasing out the individual pieces.

The stools of young babies suffering from colitis are often described as " undigested " stools, because they give the general

impression of consisting of " curds " of undigested casein. They actually consist of masses of mucus in which are entangled a number of small granules of insoluble soap, and to this they owe their milk-white colour. These soaps actually are stearates or oleates of calcium or magnesium, the precise chemical nature of which can be determined by laboratory examination. The frequency with which the stools are passed will influence their character. The more frequently they are passed the more liquid will they tend to become, and the less frequently the more solid and inspissated the mucus. In membranous colitis attacks of diarrhœa alternate with periods of constipation.

The characteristic symptoms of colitis are intermittent colicky pains, which usually occur just before or during an action, or when the peristaltic movements are particularly active. There are almost invariably nervous symptoms due to the absorption of the products of protein decomposition. These will be more particularly dealt with in the section on Intestinal Toxæmia.

Treatment. The treatment of colitis is admittedly difficult and unsatisfactory, owing to the fact that the one condition which is essential for a cure, namely, rest, is the one thing which it is almost impossible to ensure. The inflammation will be kept up and aggravated by all food elements which are not properly digested, and if not properly digested there will be decompositions which will add to the trouble. For these reasons the correct treatment must entail the provision of food which is easily digested and absorbed, leaving little residue for decomposition. It is a great mistake to keep on changing the food because the colitis still continues. The colitis will and must continue no matter what be the food, and for this reason breast feeding, which is the best of all forms of feeding, should not be relinquished just because a cure is not immediately effected. In all cases of breast feeding, however, it is most important that there should not be overfeeding, and there is no better way of preventing this than by applying the " Test feed." In artificial feeding there is in my experience nothing safer than thoroughly well-peptonized and modified cow's milk.

In older children past the milk stage, the food should be very simple and digestible. In their case, as in the case of young babies, I think that a considerable proportion of their food should be peptonized, and may with advantage take the form of Benger's Food, prepared in accordance with the instructions on page 709. Since all forms of colitis are apt to remain very chronic, it is essential that the food should contain all the necessary elements, including vitamins and mineral salts. For this reason, fruit and

vegetables should not be excluded, but it is important that they should be well prepared, cooked, and masticated. Fruits with seeds, pips, and skins, should be vetoed, and vegetables leaving hard cellulose residues, such as celery, beetroot, radishes, or carrots, should not be allowed. It is however a mistake to exclude green vegetables, such as cabbage or spinach merely because their residues, when looked for, are discovered in the stools. Of such roughage normal stools largely consist, and since their residues are soft and non-irritating the above vegetables may be allowed, but they should be well sieved before being given to young children.

Drug Treatment. The two drugs which are most useful in colitis are bismuth and petroleum, and these should be combined in varying proportions according to the degree of looseness of the bowels. Kaolin is also useful since it tends to lend some solid consistency to the stools, and is credited with the property of absorbing the toxic products of decomposition. The latter property is also possessed in marked degree by Kaylene. Opium in the form of Dover's Powders is a rational means of affording relief to the pain which is such a frequent concomitant of all forms of colitis.

Colonic Irrigation. The Plombière method of applying high colonic irrigation is among the most valuable therapeutic measures we possess for the treatment of chronic colitis. It should however only be given by an expert. In most cases it is better to employ simple sterile water for the washing out, and not have resort to any antiseptic or medicated lotion.

Constipation

The term "constipation" is loosely applied to cover two different conditions; one in which the movements of the bowel are infrequent, though possibly quite normal in consistency, and the other in which though not infrequent the motions may be hard and dry. To treat these two varieties of constipation on exactly the same lines is obviously irrational. Each requires its own special method of management in conformity with the etiological factors which are responsible for its causation.

The act of defæcation is dependent on the carrying out of a very complicated neuro-muscular co-ordination, which is elicited by a great variety of different stimuli, psychological, physical, direct, and indirect. In the case of young infants, direct voluntary control plays a very small part in the execution of the act. In them it is elicited by reflex causes almost exclusively, and habit very soon determines the frequency with which the bowels

act. Nature provides in a most admirable way for the establishment of regular and favourable habits of defæcation in the infant by the provision of the right sort of stimulation to bring about normal actions of the bowels. In the case of the new-born infant the presence of meconium in the pelvic colon serves as a most convenient didactic material for training on satisfactory lines the neuro-muscular mechanisms concerned.

The rectum is endowed with an innate capacity of expelling foreign material—in other words, the physiological function of the rectum is to be empty. Under normal conditions the rectum is empty at the time of birth, and so is the lower part of the pelvic colon. The remainder of the colon, and the small intestine, usually contain quite a considerable quantity of meconium. This is gradually squeezed into the lower part of the pelvic colon by the waves of peristalsis which pass along the intestine from the stomach onwards by the reflex stimuli of sucking and swallowing, as well as by the churning movements of the stomach, and the presence of food in the intestines themselves. When by this means the pelvic colon is distended with meconium, the reflex stimulus is provided for the discharge of the didactic material through the pelvi-rectal sphincter into the rectum, where again it serves as a direct stimulant for expulsion in the complicated neuro-muscular act of defæcation.

The establishment of regular periodic acts of defæcation depends therefore on the regularity of the periods of feeding, and the rate of the onward movement of meconium which is elicited by the series of acts which follow. A further condition for the establishment of regular habits is the presence of a sufficiency of meconium in the bowel at the time of birth to provide fæcal material for several days. If this meconium is prematurely discharged in the act of birth, or subsequently, by the administration of purgatives, the natural education of the neuro-muscular mechanisms concerned in defæcation will be interfered with. After the meconium stage, the education is carried on by the fæcal residues in the food consumed, mainly insoluble soaps.

Most cases of constipation in young infants, as well as in older children, are due to the defective education of the defæcation nerve centres during the early days of life, or to the fact that they are disorganized later by the abuse of aperients, purgatives, glycerine suppositories, or enemas. It is therefore most important to avoid these violent expedients for securing relief of the bowels.

As regards prevention, the following precautions should be observed. In the first place, since the actual taking of a feed,

and the subsequent peristaltic movements which sucking and swallowing set up in the stomach and intestines serve as direct stimuli for eliciting the defæcation reflex, it is important that the periods of feeding should be appropriately timed, and at regular intervals, and that the food itself should possess the required qualities to produce normal peristalsis. These conditions are better fulfilled in the case of natural feeding than when substitutes are employed. Colostrum itself affords just the degree of stimulation to the stomach and bowels which is calculated to secure the normal rate of carriage of the meconium into the pelvic colon and rectum. Moreover, the very limited amount in which colostrum is secreted is also a safeguard against over-stimulation through mass quantity.

When artificial feeding is substituted for natural feeding it is improbable that the necessary conditions will be so satisfactorily complied with. But the education and training of the defæcation nerve centres can be greatly promoted and reinforced by the introduction of an additional and artificial reflex, namely, that which can be provided by the application of a soap dish or porringer to the buttocks at the times the bowels are required to act. It frequently happens without some such conditioned reflex controlling the natural reflexes which contribute to an action of the bowels, that a stool is passed every time the infant has a feed. A habit of this kind is most undesirable, and is somewhat difficult to eradicate. As a rule it is found quite easy to train an infant to have two actions a day—one in the morning, and one at night, if the conditioned reflex provided by the soap dish or porringer is skilfully applied.

Nurses sometimes try to teach infants to develop regular habits of defæcation by what they call " holding out " the baby at certain definite times. Such a practice is very useful in teaching the infant to acquire regular habits of micturition, but it is quite out of place for teaching a child regular habits of defæcation. An artificial stimulus of this kind should not serve a double purpose. There should be one stimulus for urination, and another for an action of the bowels.

The Treatment of Constipation.

This subject will be dealt with under two headings :

1. The treatment of infrequent actions with normal stools.
2. The treatment of hard stools with or without infrequency.

The Treatment of Infrequent Actions with Normal Stools. Infants often fail to have an action of the bowels for perhaps several days in succession, but when the stools are passed they are found to be quite soft and normal. Under such circumstances it may be

assumed that ordinary fæcal matter is not sufficiently stimulating to bring about a reflex evacuation, or the bowel itself is " lazy." When this is the case the indications are either to render the contents of the bowel more stimulating by dietetic or medicinal means, or to render the nerve centres concerned more sensitive to stimulation. Since the rectum itself is often insensitive to the presence of fæcal matter its interior should be explored with the finger on some occasion when the bowels have failed to act, in order to ascertain whether or not it contains fæcal matter. If fæcal matter is present, it proves that the rectum has lost its sensibility and can no longer carry out its normal function, which is to be empty.

The treatment of such cases is re-education, to teach the rectum and the other mechanisms concerned how to respond to normal stimulation in a normal manner. At the commencement of treatment it is often a good thing to render the nerve centres concerned more sensitive to stimulation by giving nux vomica or thyroid preparations, in combination with cascara-segrada, or senna. Although petroleum preparations are commonly given under such circumstances as a mild aperient, the already soft consistency of the stools is a contra-indication to this practice.

The following formula may be found useful for infants 1 year old, and may be given three times a day:

Liquid Extract of Thyroid . . .	1 minim (0·06 c.c.)
Tincture of Nux Vomica . . .	1 minim (0·06 c.c.)
Aromatic Syrup of Cascara . . .	5 minims (0·3 c.c.)
Water to make 1 fluid drachm (3·5 c.c.)	

Combined with the drug treatment it is important that attention should be paid to the establishment of regular habits, by means of physical and psychological conditioned reflexes, especially by the application of the chamber to the buttocks of the infant at the time it is desired that an action should take place, and if the infant is old enough, attempts should be made to obtain its voluntary co-operation. The use of a soap stick is another effective means of stimulation, but it should not be employed unless other means fail. It affords a means of directly stimulating the mucous membranes of the rectum. If the latter means proves satisfactory, this form of stimulation should be gradually omitted.

The dietetic treatment for this variety of constipation is not so urgent as in that with hard motions, since the condition of the stools indicates that there is no serious fault in the food. But in the case of breast-fed infants it is naturally important to provide against possible underfeeding by applying the " Test

Feed." In artificially fed infants it is essential to see that the food contains an adequate representation of vitamins and mineral elements, especially vitamin B. The addition of bone and vegetable broth (see page 708) is a valuable means of ensuring the required conditions, especially if this broth contains plenty of Marmite. Malt extract is another way of providing vitamin B, and so is Bemax, if the infant is old enough to take it.

In the case of older children, one of the essential conditions is to provide an ample supply of soft roughage, such as that provided by green vegetables, turnips, baked apples, stewed fruit, etc. Fruits with hard or sharp pointed seeds, such as figs or raspberries, or particles of bran present in coarse brown bread, are much too irritating to the mucous membrane to be regarded as a safe means of stimulation.

Treatment of Hard Motions with or without Infrequency. The longer fæcal matter remains in the pelvic colon, or the longer the periods between stools, the more liable are the latter to become hard and desiccated by extraction of water. But under certain conditions the stools may be quite hard, even if one or more actions of the bowel take place every day. Consequently, in the treatment of constipation with hard stools the question of frequency must not be overlooked ; and may be treated more or less on the lines indicated in the above section. For the mere softening of the stools there is nothing so valuable as some form of petroleum given at each meal. This is better practice than giving a large single dose once a day. Further, it is wiser to give an emulsion of petroleum than to give the simple liquid oil, which mixes badly with the motions, and is apt to come away independently, leaving a " hard-stool " " in situ." The particular form of petroleum which I recommend is Semprolin Emulsion, which contains 50 per cent of the pure oil made up as an emulsion of a very agreeable kind.

In this connection I would point out that the usual practice of giving olive oil or other vegetable oils for the purpose of lubrication or softening of the stools is an irrational one, for the reason that vegetable oils if properly digested unite with calcium and form insoluble soaps, which constitute the main basis of a constipated stool. Any excess of fat, especially when combined with an adequate calcium intake, tends to produce what is sometimes described as " fat constipation," but which is better described as " soap constipation."

Both citrate of potash and citrate of soda tend to soften hard stools, partly because if fatty acids are available they lead to the formation of soluble soaps in the place of the insoluble calcium

soaps, but both in the case of infants and young children, the dietetic treatment of hard stools is preferable to any medicinal treatment.

Since the chief cause of hard motions is the presence of an excess of insoluble soaps, the rational means of preventing them is to limit the intake of both fats and calcium. Since cow's milk itself is the chief offender in this respect, both cow's milk and cream, and to some extent butter, should be limited in amount, at least temporarily, in all cases of constipation of this kind occurring in children over one year of age.

Both potassium and sodium are useful in preventing hard stools, because when they unite with fatty acids they form soluble soaps, which tend to keep the motions soft or liquid. For this reason, fruits and vegetables which usually contain large amounts of these bases, should be given under these conditions. Every opportunity should be taken to provide an ample amount of those fruits and vegetables which contain soft roughage. Among fruits, bananas fulfil the required conditions most effectively, while baked apples and stewed pears are also useful. Among vegetables, the best are turnips, cabbage, spinach, vegetable marrow, cauliflower, and boiled celery.

As meat, fish, eggs, cereals, and sugar, provide practically no roughage they should be limited in amount.

Hard motions in breast-fed infants are rather difficult to treat dietetically, since it is not possible to alter the composition of breast milk to any material extent. It is important, however, by means of the " Test feed " to make certain that the quantity consumed is sufficient, and it is possible to give supplementary feeds which may tend to render the stools softer. One supplementary feed a day may be sufficient for this purpose, and it should consist of some practically fat-free food—such as Horlick's Malted Milk.

In the case of artificially fed babies, it is quite easy to modify the food in the required direction—that is to say, to reduce, temporarily at least, the fat content and increase the carbohydrate. It is sometimes stated that malt sugar and cereal preparations have a more aperient action than milk sugar, or cane sugar. This is not so, except in so far that when any new form of carbohydrate is substituted for one that has been previously employed, the change is apt to have a laxative effect, owing to the fact that new varieties of carbohydrate food are not well digested at first, and consequently have some aperient action due to the fermentative changes which may take place in them.

Acute Intestinal Obstruction

The cardinal symptoms on which a diagnosis of acute intestinal obstruction depends are, vomiting, abdominal pain, tenderness and distension, with constipation, collapse, and toxæmia. It is however one thing to be able to recognize the existence of intestinal obstruction, and quite another to locate its seat, or determine its cause. It may be said that the higher up the obstruction—that is to say, the nearer to the stomach, the more serious are most of the symptoms, with the exception of the abdominal distension, which will be less. If the delay occasioned by the giving of a bismuth feed, or a barium enema with subsequent X-ray examination is justifiable, the information which these measures afford is most invaluable in determining both the situation and the cause of the trouble. Digital examination per rectum is most informative from all points of view. The character of the vomitus also offers information. The lower the obstruction the more stercoraceous the vomitus. If the latter contains bile, the obstruction must be below the point of entrance to the bile duct : if it contains none it is probably above this point.

The character of the stools, if any, also has diagnostic significance. Although what is called " absolute constipation " is the rule in complete obstruction, none the less in some cases there is a sanguineous discharge from the bowel, especially in intussusception, which may be mistaken for a dysenteric stool. Further than this, fæcal matter may be passed for a short time after the obstruction has occurred, if the bowels happen to be full at the time, and the same is true of flatus, which may be passed temporarily in spite of complete obstruction. But it is very strong evidence of obstruction if neither flatus nor fæcal matter continue to be passed after the first onset of symptoms. Palpation of the abdomen, especially when combined with rectal examination often affords sufficient evidence on which to base a diagnosis, not only of the nature of the obstruction, but also as to its site.

The following are the main causes of obstruction in babies and young children.

1. Obstruction from within, due to the presence of foreign bodies, or impacted fæces. This form is rare at all ages, but particularly uncommon in infants under 1 year of age.

2. Obstruction in the bowel wall itself, due to congenital atresias, is particularly common in new-born babies, in older children it is more probably due to tumours, to cicatrices or to intussusceptions.

3. Obstructions from without, by cicatricial bands or peritoneal adhesions—sometimes secondary to operations for appendicitis, by incarceration in hernial sacs, internal or external, by entanglements in connection with Meckel's diverticulum, and by volvulus.

The *differential diagnosis* between these varieties of obstruction is not always easy. Congenital atresias begin to produce their symptoms immediately after birth. If they are below the entrance to the bile duct the vomit contains bile. Such cases are sometimes mistaken for pyloric obstruction. Intussusceptions do not usually occur before the age of 4 months, and generally in well-nourished babies. A tumour caused by intussusception can generally be felt by external palpation or rectal examination, and there is usually a sanguineous discharge per anum.

External hernias resulting in obstruction are generally perfectly obvious, but internal hernias are somewhat more difficult to diagnose, but may be diagnosed by means of the bismuth feed.

Treatment. The treatment of acute intestinal obstruction can be dismissed in a few words. Unless the cause can be definitely assigned to some foreign body, or impacted fæces, no attempt should be made to relieve the obstruction by purgatives, or the pain by opium or other anodyne. Procrastination is always dangerous. If the bowels fail to be immediately relieved by a soap-and-water enema exploratory laparotomy is the only alternative, and in these days is accompanied by very little risk. In all cases however in which excessive vomiting has led to dehydration, the precaution of restoring fluid to the tissues by subcutaneous injection or intravenous transfusion of normal saline, before commencing operation, should never be omitted.

Congenital Idiopathic Dilatation of the Colon

(Hirschsprung's Disease)

This congenital anomaly consists in a gradual, progressive, and often enormous distension of the colon, accompanied by obstinate constipation. The condition does not depend on any occlusion or atresia in the colon, rectum, or anus, but on some defect in the neuro-muscular mechanisms of colonic peristalsis, which interferes with the normal transport of fæces through the lower part of the bowel, that is to say, it consists essentially of some defect in the motor functions of the colon.

The diagnosis as a rule presents no difficulties, but it has to be distinguished from constipation due to abdominal tuberculosis,

atresia of the rectum or anus, and also from severe atonic conditions of the bowel wall due to rickets or other causes.

As shown in Fig. 17, Plate IV, radiographical appearances of the colon after a barium or bismuth enema are highly characteristic, and cannot easily be mistaken for any other condition.

Treatment. This is difficult and unsatisfactory. At all costs the colon must be emptied and kept relatively empty, but it is often extremely difficult to effect the initial evacuation of the inspissated fæces, which consist mainly of soap, epithelial débris, cellulose, and other roughage material. Children suffering from severe forms of the disease often remain in surprisingly good health, even though their bowels may not be moved for weeks at a time. The reason for this is that owing to the inspissated condition of the fæcal matter, decompositions do not easily take place, and further, a thick coating of dry mucus on the bowel wall usually interferes with the absorption of toxic matter. I have frequently observed serious changes for the worse in children suffering from Hirschsprung's disease after a successful clearance of the colonic contents, but all the same, it is not safe to allow the constipation and the progressive dilatation of the colon to continue through a policy of non-interference.

Purgatives and intestinal lubricants are worse than useless as initial expedients for emptying the bowel. This must be done by direct manipulation, either by external massage or by manual extraction after repeated soap-and-water enemas given with the long rectal tube, or indeed by both these measures in combination.

Sometimes it is justifiable to administer an anæsthetic to complete the emptying of the bowel at one operation.

When the colon has been properly emptied, it must be kept as free as possible from decomposing matter, in order that the results of toxic absorption may be minimized. To ensure this, the bowel should be washed out at least twice a day by high irrigation with some mild and weak antiseptic lotion, such as permanganate of potash (pale pink) or Monsol (1 in 300). The food at first should contain very little nitrogenous material and consist mainly of carbohydrates and fats. Young infants should, temporarily at least, be fed on some such food as Horlick's Malted Milk, which leaves little residue and is mainly carbohydrate. To prevent further accumulations large doses of liquid petroleum are indicated. Kaylene-ol certainly has advantages owing to its power of absorbing toxic substances. A good emulsion is the best form in which to administer petroleum. I generally give Petroleum Emulsion to the extent of at least 1 teaspoonful at each feed, in order that the whole of the intestinal contents may



FIG. 17.—X-ray photograph of Megacolon.
Hirschsprung's disease. After Barium Enema (Dr. Bertram Shires).

be well mixed with this lubricant. Charcoal biscuits, in the case of older children, seem to help in the deodorizing of the stools, and both Kaolin and Petrolagar help to fill up the dilated colon with inert and harmless materials.

Abdominal massage is indicated at first to help empty the sacculated colon, and high irrigation may have to be continued for some weeks after the initial clearance. I do not as a rule find it necessary to give any other form of aperient in addition to the petroleum emulsion, but if the latter fails to secure a daily evacuation 10 drops of Cascara Evacuant may be added to it. I have found sour milk useful in the after treatment owing to the restraining influence which lactic acid organisms exercise on the activities of proteolytic bacteria. The wearing of a well-fitting abdominal belt helps to control the colonic dilatation. In certain cases of concomitant hypertonus of the sphincter of the anus, forcible dilatation seems to promote evacuation.

Surgical treatment consists in colectomy, the operation being completed in two stages: in lumbar sympathetic rami-section,[1] or in lumbar ganglionectomy and rami-section.[2] Although results of surgical interference are not very encouraging, all the same this expedient must be resorted to in those cases which refuse to yield to medical treatment.

Acute Appendicitis

Acute appendicitis is a very rare condition in infants under 1 year of age, and comparatively uncommon before the 5th year. Out of 500 cases recorded by Fraser in Edinburgh, there were only three under 1 year of age, eleven under 2 years of age, and twenty-two under 3 years of age, but when it does occur in infants it is a very serious condition. It is therefore important to realize that it can occur, and to know how to recognize it when it does.

The symptoms are abdominal pain, vomiting, local tenderness, rising temperature and pulse-rate. In the later stages if the peritoneum is involved, there may be impaired abdominal movement and resistance to palpation.

In infants I have found the information to be derived from a rectal examination of greater diagnostic value than any other. If the examining finger is patiently and slowly pushed through the pelvi-rectal sphincter the lower half of the abdomen can easily be reached for examination purposes, and the finger of the

[1] Wade, R. B., and Royle, N. D., *Med. Jour. Australia*, 1927, vol. I, p. 137.

[2] Judd, E. S., and Adson, A. W., *Jour. Am. Surg. Assn.*, 1928, vol. xlvi, p. 159.

examining hand made to meet the fingers of the other hand if the latter is firmly pressed on the abdominal wall.

In acute cases there is seldom time to make an X-ray examination, but in those cases in which the necessary delay is justified, the evidence is extremely valuable.

Attacks of acute appendicitis have to be distinguished from cases of chronic colitis or enteritis with exacerbations. A previous history of irregularity of the bowels with mucus in the stools makes appendicitis very improbable. Acute pyelitis is another condition with which appendicitis may be confounded, but a careful examination of the urine for pus and organisms should settle the question definitely one way or the other. Cyclic vomiting is another condition with which appendicitis in young children may be confused. Cyclic vomiting however practically never takes place in babies under 1 year of age. The absence of acetone or offensiveness in the breath can exclude cyclic vomiting.

The symptoms of renal calculi, another very rare condition in infants and young children, have certain superficial resemblances with those of acute appendicitis, but the two can be distinguished by careful examination of the urine. I remember one case however of pelvic abscess following on a suppurating appendix causing frequency of micturition and other renal symptoms which at first obscured the correct diagnosis, which was finally revealed by rectal examination.

Treatment. The chief desideratum is an early diagnosis, followed by immediate operation. The preliminary precaution of restoring fluid to the tissues which may have become dehydrated by excessive vomiting is a matter of extreme importance. I have known more than one fatal result follow operation through failure to take this precaution.

Chronic or Relapsing Appendicitis. Both acute and chronic appendicitis are very rare occurrences in infants or young children under 5 years of age, but a mistaken diagnosis may give rise to an altogether unnecessary operation. The conditions which may be mistaken for a chronic appendicitis, sometimes called a "nagging appendix," are:

1. A sub-acute or chronic colitis with exacerbations.
2. Follicular tonsillitis accompanied by abdominal pain.
3. Coli infections of the urinary tract.
4. Abdominal tuberculosis.
5. Mesenteric adenitis.

The usual symptoms of a chronic appendicitis are colicky pains referable to the umbilical area, irregularity of the bowels, slight abdominal tenderness during the attacks which are usually

of a mild pyrexial character, and general impairment of health. None of these symptoms however are pathognomonic. A rectal examination may however afford more convincing evidence, but in all cases of doubt I am convinced that a bismuth meal with subsequent X-ray examination is more likely to afford the required diagnostic information than any other means. If the appendix is normally situated, if it fills normally, empties normally and is found on screening to be completely movable by manipulation through the abdominal wall, chronic appendicitis may be excluded. I have by this means saved several young children from an impending operation. If however all the evidence points to an involved appendix, there is no alternative to surgical interference.

Steatorrhœa

An uncomplicated and classical case of steatorrhœa, that is to say, excluding that variety of it sometimes met with in ordinary cœliac disease, is such an extremely rare condition that it hardly deserves inclusion among the common diseases covered by this book. Personally, I have only had one case under my care, and that was at the Infants Hospital in 1924, but this case presented such striking features that a short account of it deserves to be put on record. Unfortunately, the child died before we had proceeded very far with our observations as to the chemistry of the stools. In this case, as in most of the others described in the literature, the stools when recently passed presented exactly the appearance of ordinary melted butter, but on cooling they became solid. No undigested protein or carbohydrate matter could be identified.

At that time we knew little about the need for fat-soluble vitamins, but I now have hardly any doubt that the child died from deprivation of the fat-soluble vitamins A and D. The failure of fat digestion and absorption was probably due to some defect in the pancreatic secretion, but it seemed to me that as far as the digestion of proteins was concerned there was nothing abnormal in the pancreatic secretion, and I presume that there is, theoretically at least, a possibility that one pancreatic function may be interfered with without the others being involved, as would appear to be the case in pancreatic diabetes. If I had another case to treat now I should no more limit the fat intake than I do in the case of cœliac disease, but I should ensure its adequate digestion by independent administration of two Zymine pepules or some other pancreatic preparation, at each meal. I should further make provision against any possible shortage in

the absorption of vitamins A and D, by giving at least 5 minims of Adexolin three times in the 24 hours.

Cœliac Disease

Cœliac disease has been included among the disturbances of the alimentary system for the reason that the peculiar nature of the stools is the most characteristic symptom, and clearly points to either failure of digestion, or absorption, or to both. The special features of cœliac disease are as follows :

1. The stools are bulky, light coloured, greasy, offensive, unduly frequent, and sometimes frothy.
2. Growth is retarded, with characteristics of infantilism.
3. There is defective calcification of the bones, and teeth (cœliac rickets), or osteoporosis.
4. The liver is usually small.
5. There is anorexia or capriciousness of appetite.
6. There is pallor or anæmia.
7. There is amyotonia, with pot-belly and dilated intestines.
8. The face is oval in shape with somewhat pointed chin.
9. The course of the disease is punctuated with recurrent exacerbations or relapses.

The combination of these symptoms makes up a clinical picture which can hardly be mistaken for any other malady, except perhaps abdominal tuberculosis. Indeed, the symptoms are so constant and uniform in character that cœliac disease was almost universally, and still is occasionally, regarded as a clinical entity with a definite congenital basis. That these views are not correct is shown by the fact that most of its victims are perfectly healthy babies for the first few months of life, and can, when the disease is fully established, be cured by careful treatment. This would not be the case if the disease were congenital in origin, or due to some definite organic defect.

In the majority of cases cœliac disease commences quite insidiously, although occasionally it has an acute beginning. As a rule there is no definite enteritis, but there are symptoms of what one may call an intestinal indigestion, with rather loose stools, which are inclined to be light coloured and offensive. These early symptoms are usually treated on dietetic lines, which include the restriction of fats, vegetables and fruit, a line of treatment which is well calculated to accentuate and perpetuate the very symptoms which the treatment is supposed to cure. In other words, cœliac disease is in my opinion an artifact disease, due possibly in the first instance to deprivation of some essential vitamin or vitamins, but certainly intensified and perpetuated by

subsequent deprivation, not only of vitamins, but also of mineral elements and by the giving of an excess of protein elements. Indeed, the chronic nature of that disease is more due to its treatment than to any innate defect.

In the main, the symptoms are due to an atrophic or sub-acute inflammatory condition of the mucous membrane of the bowel, which interferes with normal absorption of food products, and most of the other symptoms are secondary to this condition. For instance, the characteristic appearance of the stools is due partly to the want of absorption of fat, which gives them their light colour and greasy appearance, while the offensiveness is due to the decomposition of unabsorbed proteins, and the frothiness is due to fermentation of carbohydrate food, or to the presence of soluble soaps, worked up into a lather.

The retarded growth and infantilism are of course due to the defective absorption. The rachitic and osteoporotic condition of the bones is due partly to the deprivation of vitamin D consequent on the fat restriction, or to the defective absorption, and partly to the excessive excretion of calcium in the stools, an excretion which is due to the neutralization of the fatty acids with the calcium base. The anorexia, anæmia, muscular atony, and nervous symptoms, are due to the intestinal toxæmia. The smallness of the liver can be accounted for by disuse, and the relative starvation brought about by the defective absorption of all food products. The recurrent exacerbations are, I believe, due to the periodic breakdowns in liver function which are brought about by the special needs for detoxication which are imposed on this organ by the intestinal decompositions.

Treatment. The treatment [1] of cœliac disease, if it is to be successful, must take into account the atrophic and atonic condition of the whole of the alimentary tract, results which are in the first place due to a sub-acute intestinal inflammation or catarrh, and which are more often than not kept alive by the deprivation of essential food elements, and brought about by the methods of treatment usually employed.

Since comparatively little food can be absorbed, it is necessary to conserve for the essential purposes of nutrition the very limited amount of nutritive material which reaches the blood-stream. For this reason, all unnecessary loss of heat should be avoided, by keeping the child warm and well clothed. Further, all unnecessary output of energy should be obviated by limitation of exercise to the lowest possible point, even to the extent of

[1] " A New Method of Treating Cœliac Disease," Eric Pritchard, *The Practitioner*, 1934, Nov., p. 597.

keeping the child immobilized in bed should this extreme step be justified.

Frequent relapses and acute exacerbations of the symptoms are the almost universal and unhappy experience of those who have to treat cases of cœliac disease. These relapses occur at variable periods, sometimes every 2 or 3 months, sometimes oftener, sometimes after longer intervals. They are particularly liable to occur after a return home from a very satisfactory stay at the seaside, or during dentition, when a tooth is being cut. The exacerbations of the symptoms occur so suddenly, at such unexpected times, and for so many years, that more than one writer on the subject has claimed that the disease is incurable. Personally, I believe that these relapses are mainly due to the accumulated effects of the intestinal toxæmia, the chief incidence of which falls on the detoxicating functions of the liver. The limit of tolerance of the usually small, and possibly ill-developed liver of the cœliac, is soon reached if serious calls are made upon its detoxicating functions, possibly one of the most important of its many duties. When these limits are reached, the full incidence of the toxic substances which under such conditions are now circulating freely in the blood, falls on the unprotected nervous system, and thus is brought about the much dreaded relapse.

The anorexia which is one of the most obvious of the effects of this toxæmia, seems to bring about a natural cure, for the child refuses food, the sources of the intestinal toxæmia are dried up, and the detoxicating functions of the liver are once again restored, and so the history is repeated, periods of recuperation alternating with periods of relapse. A weight chart graphically demonstrates the history, the curve rising with each period of recovery, and falling again with each exacerbation.

The idea occurred to me that we should anticipate Nature's method of cure by substituting at regular intervals short periods of starvation, thus giving the liver opportunity for rest and recovery *before*, and not *after* the breakdown. Moreover, rather curious support was lent to this theory by the following incident. One of my cases, a small boy 3 years of age, who had been treated for about 2 years for cœliac disease, was brought to the Infants Hospital. After a short stay in hospital, he was transferred to our Convalescent Home, but was discharged shortly afterwards owing to the outbreak of an epidemic of whooping-cough in the Home. In spite of this precautionary measure, the child unfortunately developed the infection some 10 days after he had returned home, and I expected to hear that there had been a set-back to his progress, but 3 months later when he was again brought to the

Infants Hospital for examination, I found, greatly to my surprise, that there had been no interruption to the improvement started during convalescence, but rather the contrary—the boy had consistently put on even more weight, and was looking extremely well. Rightly or wrongly, I ascribed this happy result to the excessive vomiting from which he had suffered during the course of the attack, and to the relief which this had afforded to the liver. In fact, I believe that the vomiting had just the same effect as the enforced periods of starvation which had formed part of the treatment while under institutional care.

On the evening before the day of enforced starvation a dose of castor oil is administered, and during the actual day of starvation all food is suspended, except a practically unlimited supply of orange-juice, glucose, and water. Since this method of treatment was instituted, to which the name " The Feast of the Passover " has been facetiously applied at the Infants Hospital, there have practically been no unexpected relapses or exacerbations in the many cases of cœliac disease which have been treated at the hospital and subsequently at our Convalescent Home. The weight charts of all these cases tell the same tale. There is a continuous rise in the weight, which is only interrupted during the fortnightly periods of fasting, by quite insignificant falls in weight. There have been none of the serious interruptions which are so common in cases treated by the ordinary methods.

The chart (Fig. 18) shows the typical curve of a case treated by this method. It shows the steady improvement in weight of a very severe case of cœliac disease, treated on the lines here described.

At the time of admission the patient, a little girl of 3 years, weighed only 16 lb. She was in a very emaciated condition, and suffering from severe cœliac rickets, or osteoporosis, owing to which two spontaneous fractures occurred during the early part of her stay in hospital. At first she was so apathetic and listless that we had grave doubts of her mental condition. The fractures occurred when she began to improve and use her muscles. There were two short periods when she failed to gain in weight—the first when the weather was extremely bad : the second when one of the fractures occurred.

The chart shows clearly the fortnightly remission which corresponded with the periods of starvation and the doses of castor oil (" Ol. Ric."). These remissions were however almost invariably followed by compensatory gains, which more than made good the temporary losses.

I do not regard any case as cured unless a whole year has inter-

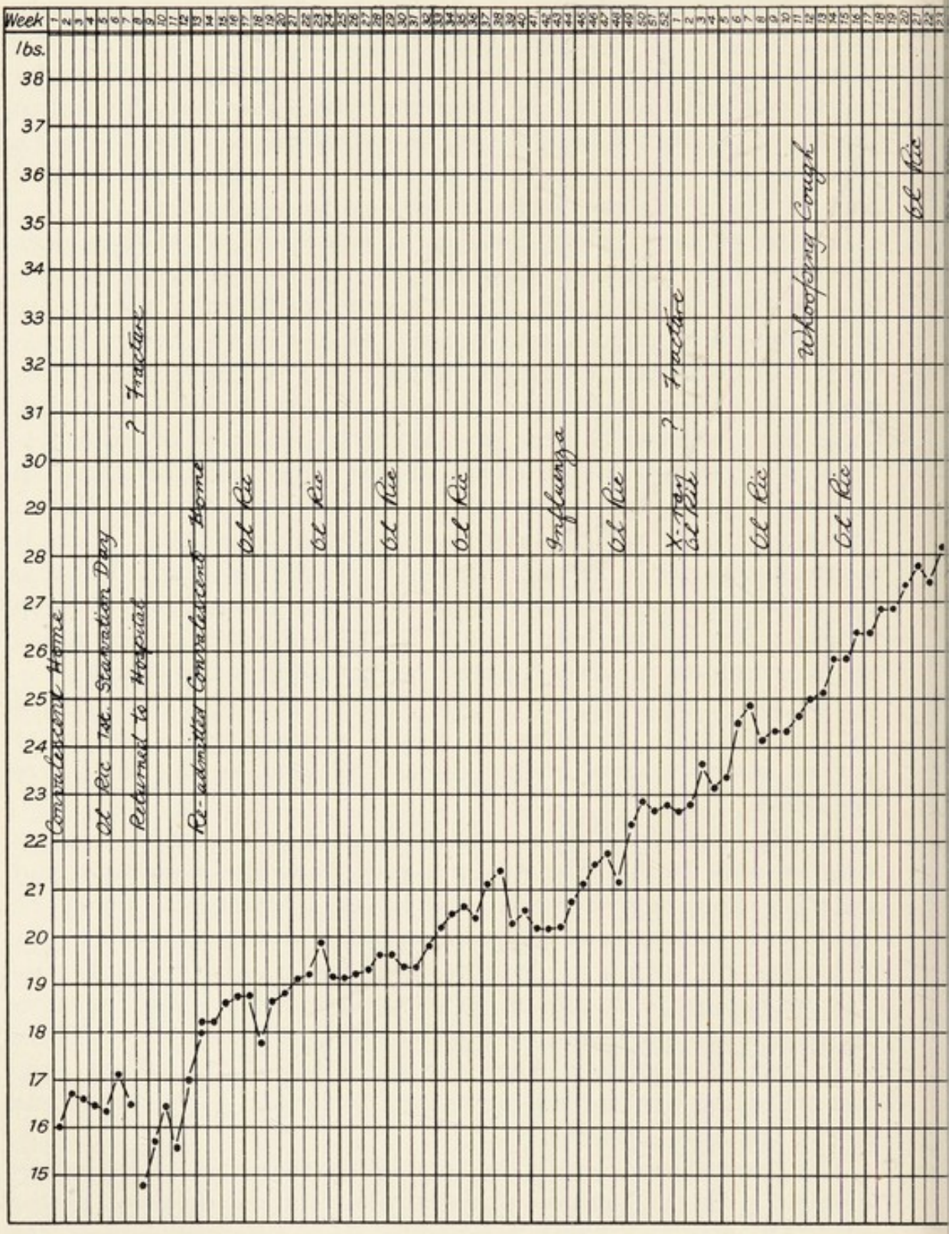
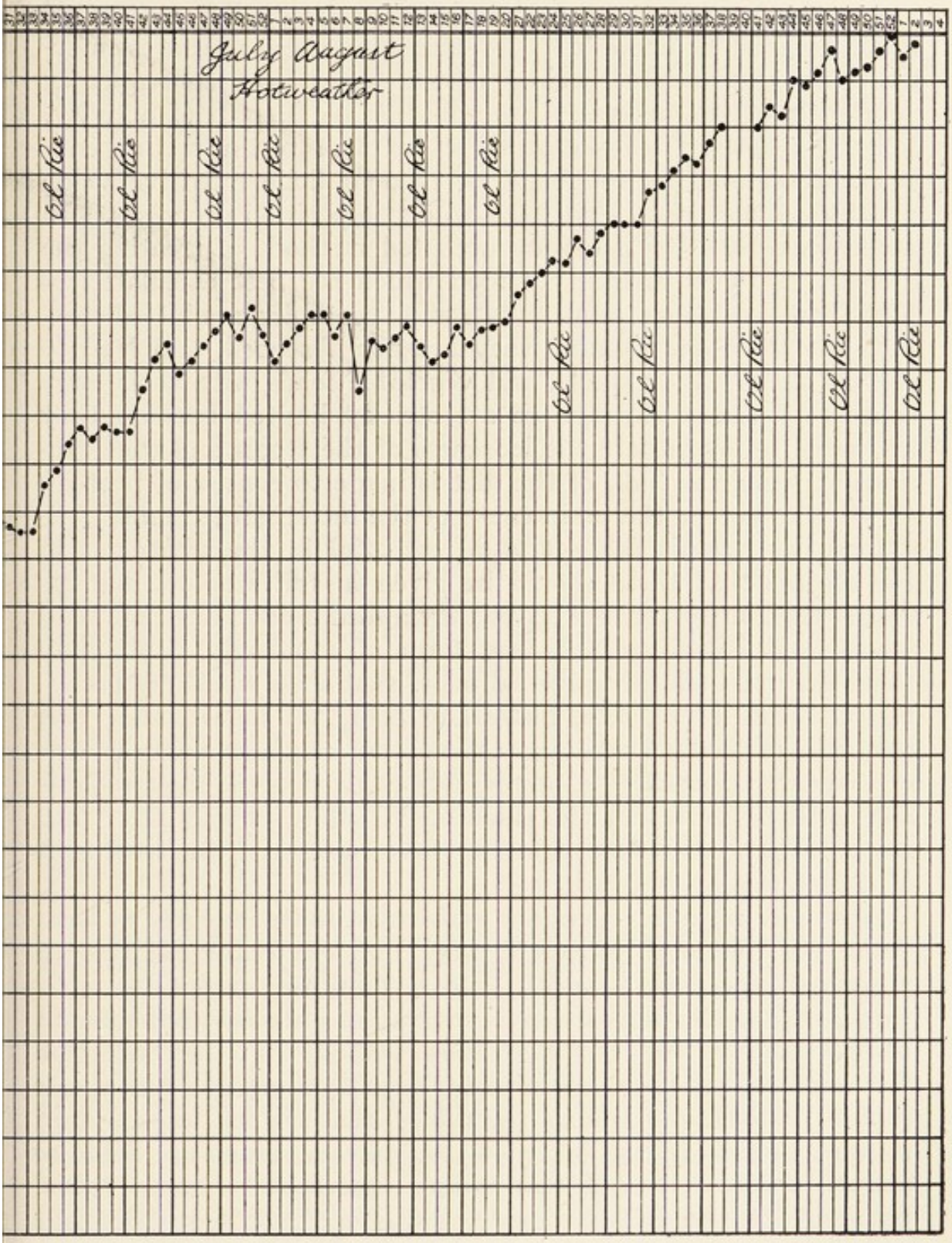


FIG. 18.—Weight Chart showing progress of cœliac case for 18 months. Th



osses correspond with the administrations of castor oil and starvation days.

vened without a definite relapse. The great difficulty however is to prevent the mothers of these children relaxing the precautions which the method of treatment demands.

As regards food, owing to its defective absorption, starvation methods must be adopted. Unfortunately these measures interfere with the adequate filling of the bowel, and consequently deprive it of the necessary stimulus for its functional activity. For this reason, it is essential to fill up the intestine with a considerable amount of roughage, or food of little nutritive value which does not easily lend itself to decomposition processes. In accordance with the generally accepted methods of treating the disease, the very varieties of food which are best calculated to fulfil these conditions, namely, fats and vegetables, are interdicted. Fats are forbidden because they are not absorbed, and lead to the passage of fatty stools, and vegetable foods with their large content of cellulose roughage are strictly limited because they are liable to accentuate the looseness of the stools and their frequency, while the bulk of the diet is made to consist of protein, which is of course the main cause of the intestinal toxæmia.

First, as regards fats—it is an essential in the treatment of the disease that these should be given in full amount, for the reason that in the form of soaps they afford a good basis for solid stools, and constitute the best form of roughage. Unhappily there exists an almost universal belief that soap stools are pathological forms of excreta, instead of being, as indeed they are, perfectly normal. Quite apart from the roughage value of fats or soaps in cœliac disease, animal fats constitute the most reliable and natural sources of the essential vitamins, A and D. Until recently the necessity for including these vitamins in the treatment of cœliac cases was overlooked.

Again, as regards vegetables and fruits, independently of their value for roughage purposes, they are serviceable sources of vitamins, especially A and C, and in addition, except for milk, they are almost the exclusive sources of mineral elements. I restrict neither fruit nor vegetables, although in their selection it is important to exclude sour fruits such as plums and raw apples (unless grated), and among vegetables, those which leave a hard residue, such as celery, beetroot, and carrots, which are liable to irritate the bowel wall and induce diarrhœa. Among fruits, bananas are the most valuable, owing to their high roughage content ; they also contain valuable mineral constituents. They should however always be given mashed. To show how well bananas can be tolerated, I recall the case of a small patient of mine, 4 years of age, whose mother interpreted my advice

that the child might have unlimited quantities, by giving him no less than twelve every day. On this diet the child did exceedingly well, but in general practice I would recommend that not more than four bananas should be given a day to a child of this age. They must however be ripe, and in good condition. Next to bananas I consider sweet oranges, melons and grapes to be the most suitable fruits. When apples are given raw they should be finely grated, otherwise, they should be baked or stewed. Stewed prunes and stewed dried apricots are excellent.

Regarding vegetables, the most useful are cabbage, spinach, brussels sprouts, cauliflower, Scotch kale, turnips, Jerusalem artichokes, vegetable marrow, and boiled onions. They should be rubbed through a sieve. The fact that the residues of these vegetables may be detected in the stools is no argument against their use, but if the stools should happen to be too loose or too frequent, the amount of them allowed can be temporarily restricted.

Other varieties of food need not be restricted. I allow all ordinary forms of food, but the total quantity must be strictly limited, and contrary to general practice, I do not encourage any excess of protein foods, such as meat, fish, or eggs, or even milk, since all these varieties of food are liable to decompose in the bowel if they are given in quantities beyond the limits of absorption. The worst consequences of cœliac disease are in my opinion due to absorption of the products of intestinal decompositions, and their toxic effect on the nervous system.

The following detailed account of the method of dieting which I employ in the case of children about 2 years of age may be found useful by others :

On waking, the juice of an orange, a tablespoonful of glucose, and one or two Nutritive Salt Triturettes (see page 696).

Breakfast. 6 oz. of boiled and unskimmed milk, flavoured with cocoa or Ovaltine if thought desirable. 2 tablespoonfuls of some cereal preparation, such as Cream of Wheat, with a teaspoonful of Bemax, and 2 oz. of milk (in which the prepared chalk may be administered). 1 slice of toast, with butter, or jam (without seeds or skins), jelly or potted meat. Banana, baked or raw grated apple, stewed prunes or apricots.

Dinner. 3 oz. bone and vegetable soup (see page 708). 1 oz. of meat, brain, liver, sweetbread, tripe, fish, or egg. 2 tablespoonfuls of strained vegetables, such as cabbage, spinach, cauliflower, turnip, Jerusalem artichokes, vegetable marrow, or boiled onions. 2 tablespoonfuls of milk or steamed pudding with fruit.

Tea. 8 oz. milk. Plain cake, biscuit, toast, or pulled bread, butter, and jam (without seeds and skins), or Marmite. Banana or stewed fruit.

Supper. Supper is not recommended, but if thought necessary should consist of calf's foot jelly, or 3 oz. broth.

Drug Treatment. Unfortunately no drug has any specific influence on the course of the disease, but rational therapeusis involves symptomatic treatment, and should be directed to the following points :

1. The provision of means for ensuring solid and not too frequent motions.
2. The prevention of acidosis, mineral depletion, osteoporosis, rickets, and anæmia.
3. The prevention of the usual results of intestinal intoxication.

As regards the first of these requisites, in order that the necessary conditions may be provided for the formation of insoluble soaps in the stools, care must be taken that the neutral fats provided in the food are broken down into their constituent elements, namely, fatty acids and glycerine, through the agency of fat-splitting ferments provided by the pancreatic secretions, or by the *succus entericus.* To ensure that these conditions are fulfilled, the stools must be submitted to chemical analysis to ascertain whether the fat which they contain exists in the form of neutral fats, fatty acids, or soaps. If the major portion consists of neutral fats, if in fact there exists a steatorrhœa, the indication is to provide an adventitious supply of some lipase ferment by the mouth. This is most conveniently done by giving at each meal one or two Zymine pepules (B. W. & Co.). If there should happen to be an excess of unsaturated fatty acids indicating a deficiency of neutralizing bases, but at the same time an efficient fat digestion, there is no occasion to give any additional fat-splitting ferment, but there is very obvious need for the supply of calcium base. My practice is to give under such conditions prepared chalk to the extent of 40 to 60 grains at each meal. If chemical analysis demonstrates an excess of soluble soaps, that is to say, of potassium or sodium soaps, this indicates that the valuable potassium and sodium bases provided by the food are being used up for the purpose of neutralization, and are being lost to the body.

A frothy condition of the stools, although not proof of the presence of soluble soaps, nevertheless is a very strong indication. Under such conditions the elimination of sodium and potassium bases must be spared and protected by the administration of prepared chalk, as in the preceding paragraph. Excess of insoluble soaps present in the stools, is an indication for the giving of extra sodium and potassium base (calcium sparers), as well as calcium itself, in order that the body may not be depleted of lime, and thus lead to a condition of osteoporosis or cœliac rickets.

As regards the prevention of the symptoms of a general mineral

depletion, included in Group 2, this to a large extent will be provided for by the adoption of the measures recommended in the foregoing paragraphs, but several mineral bases besides calcium and magnesium are liable to be used up in the neutralization of fatty acids and the formation of soaps, and this is specially true of sodium, potassium, magnesium, and iron. To counteract such a possibility in the simplest possible way, one or two tablets of Nutritive Salts (see page 696) may be given every morning, together with the orange-juice.

As regards the points included in Group 3, namely, the prevention of the symptoms due to an existing intestinal intoxication, I would refer the reader to page 696, where the particulars are given in greater detail. All the same, I would insist that the main dangers connected with an intestinal intoxication are associated with the symptoms due to the absorption of the products of protein decomposition in the bowel, brought about by proteolytic bacteria. If the nitrogenous elements consumed in the food are normally digested in the stomach and intestines and reduced to the condition of peptones and amino-acids, there is little room for that abnormal form of proteolysis which is the result of bacterial activity. Hence full attention must be given to the possibility of failure in either gastric or intestinal digestion.

In cœliac cases there is quite often some degree of hypochlorhydria, with attendant failure of peptic digestion. To discover whether this is the case or not, the gastric contents should be submitted to chemical examination some 2 or 3 hours after the taking of a meal, and if there is any evidence of a deficiency of hydrochloric acid or other free acid, the defect should be made good by the oral administration of 5 to 10 minims of dilute hydrochloric acid at each meal, or by the giving of Lactic Acid Milk (see page 44). Although there is no really effective intestinal antiseptic available for use, there can be no doubt that in cases in which there is an absence or deficiency of lactic acid organisms in the stools a considerable amount of protein decomposition can be prevented by the administration of lactic acid organisms in the form of Lactobacilline, 1 tablet after each meal, or by the use of sour milk (see page 695).

Kaolin or Kaylene-ol, given freely up to the extent of 1 or 2 drachms at each meal, is credited with the property of being able to absorb a certain amount of toxins. Charcoal biscuits may be useful for absorbing gas in those cases in which there is abdominal distension due to carbohydrate fermentation. Abdominal pains are such frequent concomitants of the cœliac condition that they may require special treatment. For these,

bismuth in the form of Glycerinum Bismuthi Carbonatis is excellent, or in those cases in which there is an accompanying constipation, as is often the case when this method of treatment is adopted, there is nothing better than that combination of Petroleum Emulsion and Glycerinum Bismuthi Carbonatis, which is described in the appendix (page 692) as Cremor Bismuthi.

Under this method of treatment, by which fats are not excluded from the dietary, there is not as a rule any special necessity to administer either vitamin A or D independently of the food, but at the commencement of treatment, especially in neglected cases, in which there has been heretofore a shortage in the supply of these vitamins, it is as well to give them in concentrated form. There is probably no better preparation than Adexolin, which may be given in doses of 5 minims three times a day.

Round Worms

(Ascaris Lumbricoides)

Round worms are so extremely unlikely to be found in babies that their treatment may be dismissed in a few words. I do not recommend santonin for their treatment any more than I do for the treatment of thread worms. It is better to give a few drops of Oil of Chenopodium (5 drops for a child 5 years of age), followed and preceded by the administration of an aperient.

Tape Worms

No variety of tape worm, of which there are many, is likely to be found in babies under 1 year of age, and very little more so in those between 1 and 5 years of age. I have however known several cases of membranous colitis in which long casts of the bowel have been passed per anum, and mistaken for tape worms and treated as such, mistakes which are inexcusable. Should however a definite diagnosis be made that a tape worm actually exists, the treatment must not be taken too lightheartedly, for the sensitive mucous membranes of babies cannot tolerate the drastic treatment which can safely be meted out to older children. Male Fern is the most reliable anthelmintic, but it is definitely irritating to the mucosa, and quite useless in very small doses. Male Fern should be given in the form of an emulsion and freshly prepared. It should be preceded by a good clearance of the bowels with syrup of figs and followed 6 hours later by another dose of this aperient. If this treatment fails, it should be repeated with slightly increasing doses of the extract of Male Fern, and at

intervals of about a week, until the head of the worm has been discovered in the motions. After the administration of the anthelmintic all evacuations should be very carefully examined by washing out with a large quantity of water and straining through some dark-coloured gauze against which the white head and segments of the parasite will show up in relief.

Thread Worms

(Oxyuris vermicularis)

In this country thread worms are the only variety of worm which is likely to infest the alimentary tract of babies. They are very rarely present before the 2nd year, that is to say, before the child can move about and handle sources of infection. The latter generally results from the eating of raw garden produce, although the eggs may be conveyed from one child to another in various ways. For this reason great toilet cleanliness must be observed in families or institutions in which one child is infected, and the nails of the children must be kept well cut and short. The children should also wear tights or bathing drawers which render access to the anal region impossible, and thus prevent infection by means of the fingers.

Children who manifest the ordinary symptoms of catarrhal inflammation of the bowels are often thought on insufficient grounds to harbour worms. Small threads of inspissated mucus or little pieces of vegetable fibre, especially that of bananas, may present superficial resemblances to thread worms, but a diagnosis of thread worms should not be made unless the parasites or their eggs have been definitely identified by some competent authority.

The successful treatment of thread worms is admittedly difficult, owing to the tenacity with which both the parasites and their eggs adhere to the sticky surface of an unhealthy intestinal wall. Although the female worms are often found in large quantities in the rectum and can be removed by local irrigation with an ordinary Higginson's syringe, this does not as a rule solve the problem of eradication, for other worms of both sexes may still maintain their foothold in such inaccessible places as the cæcum or appendix, or even higher up in the small intestine in fissures or folds of the mucous membrane. One female Oxyuris may contain many thousands of ova in her egg sac. The only satisfactory way of removing all the worms, and it must be remembered that a cure cannot be considered to be effective as long as a single worm remains behind, is by high irrigation,

conducted on the Plombière system, and combined with external manipulation or massage of the appendix or appendicular region.

For the successful carrying out of this method it is usually necessary to repeat the irrigations every day for at least a week. In employing this method it is quite astonishing what an enormous quantity of mucus is washed away, and what a variety of undigested articles of food are found in the wash-outs, indicating the degree of the catarrh and the cause which keeps it alive.

It is often said that the Oxyuris cannot exist in a healthy intestine, and it certainly is my own experience that the really troublesome cases are those in which there has been a pre-existing intestinal indigestion or colitis, but whether the catarrhal condition of the bowel explains the persistence of the worms, or the presence of the latter is the cause of the catarrhal condition, is still a moot point. Possibly there is truth in both views, and the existence of a vicious circle. In any case the treatment essentially consists in restoring to health, or maintaining in health, the intestinal mucosa, and in preventing any delay in the transit of the intestinal contents. To achieve this end there is nothing in my experience so successful as the regular administration of a good petroleum emulsion, such as Semprolin, which must be given in small quantity every time food is taken, to ensure its uniform admixture with the fæces and to keep the parasites on the move. The exact dosage will depend on the behaviour of the bowel. The addition of alkalies, such as citrate of potassium, or soda, helps to prevent inspissation of the mucus, and keeps it liquid. Iodides and Vinum Ipecacuanha may promote the same objects. In those cases in which at the beginning of treatment there is a very large number of worms in the rectum which cause irritation, or which sometimes escape in female children from the anus and find their way into the vagina, it is a good plan to insert into the rectum or vagina a Quassia suppository at night-time, or after the bowels have opened.

In the treatment of thread worms I do not recommend the use of santonin, as this drug seems to me to be more toxic to the child than to the worms. Neither do I recommend Naphthaline, Butolan, or other anthelmintic, given by the mouth, or added to the water which is used for the purpose of irrigation.

Rectal Polypus

This condition is not uncommon, even in quite young infants. It takes the form of a smooth, dark red or purplish swelling, not unlike a cherry, attached to a pedicle, and sometimes extruding from the anal ring during the act of defæcation. There is

also at times a passage of blood or blood-stained mucus with tenesmus.

There is no treatment for this condition other than the surgical one of removal by twisting off the growth with a wire snare or with forceps.

Fissure of the Anus

Fissure of the anus is often a troublesome matter, since the pain caused by it may lead to spasm of the sphincter, and secondary constipation. The infant generally cries when it passes a motion and traces of blood or blood and mucus may be found streaking the surface of the constipated fæces. Small fissures are difficult to find on examination, but if the child is placed on its back with its legs elevated the anal aperture can usually be opened and the mucous membrane sufficiently everted to reveal the site of the crack or ulceration.

The prophylactic treatment consists in regulating the bowels. Although constipated motions are the usual source of the trouble, frequent actions will certainly aggravate and help to perpetuate the lesion. The aim of treatment should be to secure the passage of one soft buttery stool of small calibre every 24 hours. This end can only be obtained by dietetic expedients and careful training, but hard motions may be softened by the administration of a sufficiency of Petroleum Emulsion given at each feed. Cremor Bismuthi (page 692) is also useful owing to its soothing and healing qualities.

Local treatment is also important. The anal sphincter must be kept as clean as possible and as free from fæcal matter as can be secured by careful sponging and drying after each action. A cream consisting of tannic acid, ichthyol and bismuth (page 700) should be applied to the inside of the sphincter after the drying has been completed. In very bad cases in which there is obstinate constipation the sphincter may be smeared with an ointment of cocaine just before the expected action, and touched with Lunar Caustic after a thorough cleansing of the ulcer to stimulate healing.

Hæmorrhoids

Hæmorrhoids are by no means uncommon even in young infants. They are usually due to constipation or serious congestion of the rectal mucous membrane from straining or other cause, but have to be looked for very carefully before they can be discovered. They must be distinguished from those small purplish congenital tumours of the nature of fibro- or nævo-lipomata, which are

sometimes discovered immediately after birth presenting at the anterior aspect of the anal aperture and looking remarkably like hæmorrhoids, but if they are present at the time of birth this fact should exclude a wrong diagnosis. Neither external nor internal piles require much treatment in babies other than careful regulation of the bowels, but should they ulcerate and bleed they must be referred to the surgeon for operation.

Ischio-Rectal Abscess

This condition is by no means uncommon even in young babies. It is said to be due to lymphadenitis, secondary to proctitis or local infection. The majority of cases I have seen myself have been part of a general furunculosis of staphylococcic origin. Very occasionally the abscess may be tuberculous. Except in the latter case the abscess cavity soon heals up after evacuation of pus.

Fistula in Ano

Fistula of the anus is a very rare condition in infants, or even in young children, but it very occasionally follows a rectal abscess of tuberculous origin. There is however a congenital variety from which there is a continuous discharge of fæcal matter through an external orifice at the side of the anus. For this there is no alternative treatment except surgical operation.

Prolapsus Ani and Recti

Prolapsus ani and recti merely represent the same condition in different degree. When it is confined to the ring of mucous membrane immediately above the anal sphincter it is called prolapsus ani, but the involvement of any part of the mucous membrane above this point justifies the term prolapsus recti.

The causes and treatment are the same in both cases. Both are due to inco-ordination of the motor functions of the lower bowel, and to straining from either constipation or diarrhœa, and the conditions are predisposed to by a voluminous condition of the bowel wall, which itself is generally due to over-feeding, or bad feeding. I have seen more cases of prolapse during troublesome dentition than at any other time. In these cases I regard it as due to inco-ordination of the neuro-muscular mechanisms concerned in peristalsis or defæcation which results from the general nervous disturbances which usually accompany the eruption of the teeth.

As regards treatment, the important point is the prevention. This is best secured by careful regulation of the dietary, and the prevention of either loose or constipated stools. I have found the

giving of adequate quantities of vitamin B, in the form of Malt Extract, Marmite, or other yeast preparations, a most useful prophylactic from this point of view. Just as I have never seen a case of intussusception in a baby who has been well supplied with vitamin B, so have I never seen a case of prolapsus ani or recti except when this precaution has been neglected.

The most common fault in the feeding which produces prolapse is undoubtedly over-feeding of any kind, but the giving of unmodified cow's milk, either in the dried or liquid form is also a prolific source of the trouble, owing to the constipation to which this form of feeding disposes. A shortage of fat is another frequent cause, owing to the fact that with a shortage of fat there must be a shortage of roughage, namely soaps, which are essential for the formation of normal stools.

Treatment. The curative treatment is admittedly difficult. Careful regulation of the bowels is essential, and the correction of both constipation and looseness of the stools. Vitamin B should certainly be supplied in sufficient amount but cannot be expected to be as efficacious in its curative as in its prophylactic capacity. For regulating the bowels, whether too loose or too hard, there is nothing in my experience to equal the combination of bismuth and petroleum which is provided in the Cremor Bismuthi described in the appendix (page 692). If teething troubles complicate the situation, bromide in full doses, say from 5 to 10 grains, is invaluable as an addition to the Cremor Bismuthi. General tonic treatment is also indicated, and as a nerve tonic calcium-glycerophosphate, in doses of 1 to 2 grains, may also be added to the Cremor.

As for local treatment, I have little faith in the usual expedients recommended for these conditions, such as the suspension of the legs, strapping of the nates, or making the child pass its motions on its back or lying on its side. The important point is to prevent straining of every kind from diarrhœa, constipation, or even coughing, and by making the passage of fæces through the rectum and anus as easy as possible by lubrication with paraffin, given by the mouth, or inserted per rectum, and by returning the prolapsed bowel as quickly as possible after it has come down by manipulation with an oiled rag. The insertion of cone-shaped pieces of ice into the rectum after returning the prolapse, as also the injection of ice water, helps to reduce congestion and to tone up the relaxed mucous membrane.

As for surgical treatment, in my experience the injection of paraffin or alcohol into the soft sub-mucous tissues around the bowel is quite useless, and I have not seen much better results

from linear siccatrization with the Pacquelin cautery. If however patience and medical expedients fail, as they sometimes do, stitching up of the redundant folds of mucous membrane of the bowel to the subcutaneous tissues at the level of the pelvic brim, or actual resection of a length of prolapsed gut may be the only alternatives.

The Liver

The liver is the largest and most active of the metabolic organs, in fact the greatest chemical factory in the body, and in conformity with the far-reaching importance of its multiple functions the troubles to which their failure gives rise are not only countless in number, but diverse in character and serious in their consequences.

In view of the great importance of the many and varied functions of the liver, it is most regrettable that there is no polyvalent test of its general efficiency. The lævulose and galactose tolerance tests (pages 719 and 720), afford valuable criteria of the efficiency of one of its functions, namely, that connected with the metabolism of sugar, but there are no grounds for assuming that either of these afford any reliable information with respect to the efficiency of any or all of its other functions, such for instance as those connected with its fat, amino-acid, or pigment metabolism, or with its hæmogenic, detoxicating, or deodorizing functions, for none of which there are as yet any trustworthy tests if we except the van den Bergh reaction.

The main functions of the liver are as follows :

Firstly : the so-called glycogenic functions, namely, those connected with the regulation of the sugar concentration of the blood.

Secondly : the bile-excretory functions.

Thirdly : the deaminating functions.

Fourthly : the detoxicating functions.

The glycogenic functions are important because among other results neurasthenic symptoms are apt to supervene when the sugar concentration falls below normal.

There is no need to explain at length the bile-excretory functions. They are concerned with the removal from the blood of the products of the breakdown of the red-colouring matter of the blood.

The deaminating functions are important, because they are concerned with the break-up of the amino-acids into nitrogenous and non-nitrogenous fractions, with the final formation of urea, ammonium salts, carbonic acid, and water, all of which are non-toxic substances and capable of easy elimination. When this

function fails, the amino-acids, some of which are distinctly toxic, tend to accumulate in the blood and produce a complex of symptoms, to which Oriel [1] has given the comprehensive name of Ichthyosis-Asthma-Hay Fever-Eczema-Prurigo-Urticaria-Migraine syndrome, or more shortly, the Asthma-Prurigo syndrome.

Intestinal Toxæmia

As for the results of the failure of the detoxicating functions, one can only say that the comprehensive title of " Biliousness " which is often applied to this is not nearly comprehensive enough, nor is the term " Intestinal Toxæmia." The detoxicating functions of the liver cannot save the body from all the noxious effects of circulating poisons, or indeed from very large quantities of those products of decomposition which are least harmful, but when these functions are working well and effectually, they can do a great deal. In a sense its deaminizing function should be included among those which are concerned with detoxication, but the former refer to its influence on physiological, and the latter to its influence on pathological products. The detoxicating functions are mainly concerned with the rendering harmless of those poisonous products of decomposition which are the result of bacterial activity in the bowel. At all times there is a vast production in the intestine of the products of putrefaction or decomposition through the activity of proteolytic bacteria. Some of these, such as skatol, cressol and indol are volatile bodies with very disagreeable odours, but not particularly poisonous. These bodies are under normal conditions absorbed by the blood and carried through the liver where they are converted into harmless and odourless sulphur compounds, which are excreted in the urine. When this particular detoxicating function of the liver breaks down these foul-smelling bodies remain in the blood and are eliminated unchanged by the lungs, kidney, and skin. Offensiveness of the breath is the best indication of the failure of this particular hepatic function.

However disagreeable may be such results of failure of this function, they pale into insignificance in comparison with the seriousness of the nervous and constitutional symptoms, which develop from the circulation in the blood of other bacterial toxins which escape incineration in the furnaces of the liver. When the detoxicating functions of the liver cells are overwhelmed from overwork the products of intestinal putrefaction as well as toxins

[1] Barber, H. W., and Oriel, G. H., *Brit. Med. Jour.*, Nov. 17, 1928, p. 880.

of other origin circulate freely in the blood and lead to loss of appetite, feelings of tiredness, sleeplessness, nervous irritability, stupor, or even convulsions.

It is by no means clear to what extent failure of one hepatic function can occur without involving others. It is probable that certain diseases of the liver such as cirrhosis or acute yellow atrophy, may involve all its functions, whereas disturbances of the bile-excretory and deaminating, as well as of the detoxicating functions, may possibly occur singly leaving the others unaffected. Unfortunately we have no reliable means of measuring liver function, as a whole or with respect to certain of its individual factors.

From whatever cause the hepatic functions of the liver may be adversely affected the treatment is to reduce its load, and not to attempt to spur it on to greater exertions by means of stimulation. That is why in most cases simple purgation and starvation are the most reliable cures for all those indefinite symptoms such as loss of appetite, lassitude, headache, and sickness, commonly described as biliousness, and which are definitely due to breakdown of the deaminating or detoxicating functions of the liver. This is so because by purgation and starvation the sources of protein decomposition in the bowel are temporarily dried up. This is also the explanation of the successful treatment of the same symptoms by glucose, a variety of food which cannot in itself lead to an intestinal toxæmia.

There are many other causes of breakdown of liver function besides actual overwork. There are for instance nervous causes, and there are those which are usually included under the title of organic causes, such as enlargement of the liver due to tumours or congestion, or of inflammation of the biliary system, or of the liver cells themselves. Each of these requires its own particular line of treatment.

Biliousness, or Liver Inefficiency due to Nervous Causes

It is a matter of common knowledge that nervous excitements such as parties, theatres, journeys in trains or motor-cars, overwork, eye-strain, worries, or even East winds, can cause bilious attacks, not only in children but in persons of all ages. The treatment in such cases must obviously be concerned mainly with prophylactic measures, that is to say, in the prevention of attacks by obviating the nervous causes which produce them. A good deal can be done however during the actual attack to mitigate the consequences or accelerate the cure by relieving the liver of as much work as possible by purgation and temporary

starvation. Nothing should be given by the mouth except water, glucose, orange-juice, or perhaps a little weak tea. Biliousness due to nerve causes is the form which responds best to drug treatment, since the attacks only occur occasionally, and generally last only a short time. Phenacetin, Anti-Kamnia, caffeine, and possibly the bromides, are all excellent in their way. One grain of any of the first three should be sufficient, but not less than 4 or 5 grains of bromide will have much effect. I do not advise the use of cholagogue drugs, such as calomel, Grey Powders, colocynth or podophyllin, although they may possibly stimulate hepatic metabolism, or at least the excretion of bile. The objection to them is that they are apt to leave the liver in a still more exhausted state.

Enlargement of the Liver

Very considerable enlargements of the liver can take place from various causes without producing jaundice or any other of the more obvious symptoms of hepatic inefficiency. For instance, simple passive congestion from tricuspid regurgitation or cardiac insufficiency, multiple abscesses secondary to umbilical sepsis, miliary tuberculosis of the surface (capsular hepatitis), or of the substances of the liver, interstitial hepatitis of syphilitic origin, fatty degeneration from acute infections, or malignant tumours of the sarcomatous type, all may cause painless enlargement of the liver without ascites or jaundice. In my experience uncomplicated rickets is not a cause of hepatic enlargement, although it may be a result of some associated or contributory factor in the etiology of this disease.

The treatment of all these cases must be directed to the primary cause, and to the relief of such secondary symptoms as those of indigestion, but it cannot be expected to have very encouraging results.

Jaundice

Jaundice may occur from many causes ; some obstructive, some hæmolytic. The varieties which occur in new-born infants present certain special features and have been dealt with in the chapter which treats of neo-natal diseases (page 131).

Obstructive Jaundice. This includes the catarrhal variety, that due to gall-stones, new growths, malformations, and fibrous bands pressing on the bile ducts or interfering with the escape of bile through the ductus choledochus into the duodenum, as well as biliary cirrhosis of congenital or syphilitic origin.

Jaundice due to gall-stones is very rare in infants. That due

to malformations or other congenital causes is beyond treatment: while little can be done for the syphilitic variety beyond the specific treatment of the primary disease. Thus the treatment of the catarrhal variety is the only one to which it is necessary to refer in detail.

Catarrhal Jaundice. Catarrhal jaundice is probably always infective, spreading from some centre of inflammation in the duodenum. Sometimes it takes an epidemic form. The stools are light-coloured from absence of bile pigment, while the urine is dark-coloured from excess of it. The liver is slightly enlarged: there is itching of the skin, and nearly always some concomitant gastro-intestinal disturbance.

The treatment should mainly be directed to the prevention of constipation and intestinal toxæmia consequent on the cutting off of the bile supply to the duodenum. Under normal conditions many ounces of bile flow into the intestine during the 24 hours, and since bile contains a large amount of mucus which acts as an intestinal lubricant, the treatment should make provision for some efficient substitute. For this purpose no drug excels petroleum, and it is best given in the form of an emulsion. For the treatment of the catarrhal inflammation which occludes the bile ducts and the maintenance of the bile itself in a liquid condition, Ipecacuanha Wine, citrate of soda, and iodide of potash are indicated. Since the supply of the pancreatic secretion is often simultaneously cut off with the bile supply owing to obstruction of the ductus choledochus, it is as well to give Liquor Pancreaticus in conjunction with the above drugs. All of them can be combined in one and the same formula as follows:

℞

Ipecacuanha Wine	5 minims (0·3 c.c.)
Citrate of Sodium	5 gr. (0·3 gm.)
Iodide of Potassium	1 gr. (0·06 gm.)
Solution of Pancreas (Benger's)	10 minims (0·6 c.c.)
Semprolin Emulsion	to 1 drachm (3·5 c.c.)

Mild diuretics and diaphoretics may assist in the elimination of bile pigments and salts by way of the kidneys and the skin, and thus relieve the irritability of the latter. Diuretin may be given with the same object, and 4 grains may be added to the above emulsion without constituting an excessive dosage. The skin may be sponged with a dilute solution of Liquor Carbonis Detergens (1 in 100) to allay skin irritation.

As for the dietary, this should include an ample supply of water, preferably hot and given between feeds, and made agreeable with orange-juice and glucose. During the acute stage the

food generally, but fats in particular, should be strictly limited. If the infant is breast fed it should on no account be weaned, but the total quantity of breast milk should be kept within reasonable limits by means of " test " feeding, and its fat content controlled as far as possible by letting the infant take the fore milk, while the richer " strippings " are removed by expression after each feed. Older infants, if past the bottle-feeding stage should be fed mainly on orange-juice, barley water, vegetable broth, calf's-foot jelly, and small quantities of Horlick's Malted Food. Ordinary cow's milk should only be given in very small quantities, or not at all, until the acute symptoms have subsided.

Diseases of the Pancreas

Since the pancreas may be regarded as the most important of the organs of digestion, or at least as the one which secretes the largest quantity and the greatest variety of enzymes, it may be concluded that its organic or functional derangement must be responsible for serious indigestion in babies. Most forms of intestinal indigestion in infants benefit more immediately from pancreatic therapy than from any other form of treatment.

Of the organic diseases of the pancreas there are few which require consideration here, but varying degrees of pancreatic insufficiency are probably exceedingly common and will be briefly described.

Acute Pancreatitis. This may be a complication of mumps. It is practically unknown in infants under 1 year of age. A few cases of hæmorrhagic pancreatitis and of doubtful etiology have been described in infants, but since it is invariably fatal and quite unaffected by treatment it does not require consideration.

Chronic Pancreatitis. This may be of syphilitic origin. Other forms merely display the symptoms of pancreatic insufficiency, and may be treated on the lines indicated in the following paragraph.

Pancreatic Insufficiency. The pancreatic secretion contains enzymes for digesting proteins (trypsin), for fat splitting (lipase or steapsin), and for digesting starch (amylase or amylopsin). The optimum reaction to activate these ferments is slightly on the acid side of neutrality, and not alkaline as generally supposed. The obvious results of pancreatic insufficiency are :

1. The decomposition of protein foods in the bowel, with the usual symptoms of intestinal toxæmia (pages 223 and 695).
2. Fatty stools due to the failure of the fat-splitting process.
3. The presence of starch granules in the stools, in those cases in which starchy foods are consumed.

The stools consequently will be copious, light-coloured, greasy, and stinking. One particular form of infantilism has been ascribed to pancreatic insufficiency, and perhaps correctly so, for malnutrition and delayed development are the logical results to be expected from failure of pancreatic digestion, but this form of infantilism must be carefully distinguished from cœliac disease (page 206).

Treatment. This is simple. It involves the supply by the mouth of an adequate amount of pancreatic enzymes derived from animal sources. Since the success of the treatment depends on the activity of the preparation used it is important to test the quality of the artificial substitute before placing any reliance on its efficacy. Convenient forms in which to prescribe the pancreatic enzymes are Zymine, grains 3 (B. W. & Co.) after each feed, in a small quantity of milk, or Liquor Pancreatis, (B.P.) minims 10, added to each bottle or given immediately afterwards.

CHAPTER VIII

DISEASES OF THE RESPIRATORY SYSTEM

Congenital Defects of the Nose

Congenital Atresia of the Posterior Nares (Choanæ). This condition represents a persistence of the naso-pharyngeal membrane. The defect may be unilateral, or bilateral, and may consist of bone or membrane.

In bilateral cases nasal respiration is impossible, mucus dribbles from the anterior nares, and deafness is common.

Treatment. Treatment is by operation, and follow-up treatment, with passage of bougies.

Deviation of the Septum. Although this is a congenital condition, the defect is little noticeable at birth, but becomes accentuated as the child grows older. It is often associated with palatal abnormalities, such as narrow or high-arched roof to the mouth. It is a contributory factor to narrowing of the nasal passages, rhinitis, sinusitis, otitis, and asthma, while later it may lead to asymmetry and deflection of the whole nose, which is a serious disfigurement.

Treatment. Sub-mucous resection of the septum is the only rational method of treatment, but nose surgeons are as a rule unwilling to undertake the responsibility of operation in the case of children for fear of interfering with the normal development of the nose. I do not know exactly at how early a date an operation for resection should be undertaken, but I have in more than one instance advised the operation in children as young as 12 years, in whom perfect development of the nose has subsequently followed. With an early operation it is essential that not too much of the cartilaginous portion of the septum should be removed, and that surgical zeal should be restricted to the removal of redundant osseous growth and "spurs."

Apart from, or pending resection, the same objects, but not so effectually, can be subserved, that is to say, greater space may be obtained in the anterior nares by cauterization of the inferior turbinates, or indeed, by partial amputation.

In lieu of these surgical methods, the anterior nares may be enlarged by specially designed exercises in which the nasal orifice on one side is closed with the finger, while the child is made to take forcible inspirations through the occluded side.

For the relief of any existing catarrh, nasal bougies (see page 708) may be passed at bedtime.

DISEASES OF THE UPPER AIR-PASSAGES

Acute Rhinitis (Catarrhal Rhinitis, Coryza).

This condition may be due to various causes. The common infective cold (cold in the head) is probably the main cause of acute coryza. It may however be a prodromal symptom of measles or whooping-cough, or it may be a direct result of a gonococcal, diphtheritic, or syphilitic infection of the nares. A slight running of the nose (rhinorrhœa) is a common reflex result of teething, while hay-fever, one of the allergic conditions, can also produce a vascular form of rhinitis, which in its origin and treatment is quite distinct from any of the above varieties.

It may be noted that the common cold does not by any means run the same course in infants as it does in older children. There may be very little coryza, while there may be very severe constitutional symptoms, with vomiting and diarrhœa, results which may confuse the diagnosis.

Treatment. *Prophylactic.* Prophylaxis includes avoidance of chills and all contact with infected persons. Dilution of possibly infected air by well-regulated room ventilation: protective inoculation with anti-catarrhal vaccine (P. D. & Co.). Owing to the small dosage required in the case of infants or children under 1 year of age, this vaccine must be diluted and three consecutive doses of $\frac{1}{2}$, 1, and 2 minims respectively, of the undiluted stock vaccine given at weekly intervals. Protection only lasts for about 3 months.

Curative. Whether or not it is possible to abort in their early stages, coryzal infections in infants, I think there can be no doubt that resistance is raised and the severity of the attacks mitigated if, on the first intimation of symptoms, the child is given a mild aperient (1 drachm syrup of figs) followed by a diuretic and a diaphoretic. I am old-fashioned enough still to adhere to the early Victorian nostrum mindererus and sweet spirits of nitre, the exact formula for which, for a baby 1 year old, is 1 drachm of dilute solution of ammonium acetate, with 15 minims of spirit of nitrous ether given in a suitable vehicle.

I believe this combination usually acts better in promoting the action of the skin and kidneys than some of the more modern synthetic preparations such as aspirin or antipyrine.

This treatment combined with a hot bath and a hot drink, consisting of black-currant tea, lemonade, or orangeade, given at the first onset of the symptoms, is about as much as can be done in the way of treatment in the earlier stages.

The subsequent treatment should be conducted in accordance with the stage arrived at by the nasal inflammatory process. At the beginning the mucous membrane of the nose is dry and irritable. The rational treatment for this is to promote secretion by giving ipecacuanha, iodides, and citrates, and to allay irritation by some such simple and safe preparation of opium as paregoric. The following is the formula :

Wine of Ipecacuanha	5 minims	(0·3 c.c.)
Citrate of Potassium	5 gr.	(0·3 gm.)
Iodide of Sodium	1 gr.	(0·06 gm.)
Tincture of Camphorated Opium	2 minims	(0·13 c.c.)
Syrup	30 minims	(1·8 c.c.)
Peppermint water to make 1 fluid drachm		(3·5 c.c.)

Dose : for a baby 1 year old, 1 (fluid) drachm (3·5 c.c.) three times a day.

The next stage is reached when secretion is free, and no longer requires encouragement. The removal of the secretion may be promoted by inhalations of Friar's Balsam (3 drachms of compound tincture of benzoin to the pint of boiling water), and by the giving of squills, benzoin and belladonna by the mouth, in accordance with the following formula :

Oxymel of Squill	10 minims	(0·6 gm.)
Compound Tincture of Benzoin	5 minims	(0·3 gm.)
Tincture of Belladonna	2 minims	(0·13 gm.)
Syrup	30 minims	(1·8 gm.)
Peppermint water to make 1 drachm		(3·5 c.c.)

Dose : for a baby 1 year old, 1 drachm (3·5 c.c.) three times a day.

In the case of babies and young children who are unable to blow their noses, there is ample room for ingenuity in devising means for removing the secretion. The nose may be squeezed between finger and thumb, from above downwards, or the nostrils may be cleared by inserting a small tampon of cotton-wool wound round the end of a wooden match or probe, or better than either of the foregoing, the nose may be gently irrigated with a nasal douche consisting of glycothymolin solution (1 in 8). To carry out this operation successfully the infant must be placed in the

recumbent position and the lotion dropped slowly into the anterior nares and allowed to run along the floor of the nose to the back of the pharynx, where it and the dislodged mucus is got rid of by swallowing or spitting. In my opinion there are no genuine grounds for believing that this treatment may lead to otitis media by the passage of infective matter up the eustachian tubes; infection is more liable to result from the non-removal of the peccant material.

Another way of treating the inflamed mucous membrane of the nose, and getting rid of the secretion, is to spray into the cavities of the nose Neo-protosil or Ephedrine inhalation compound (P. D. & Co.) by means of a nebulizer.

I do not advise the therapeutic application of " cold " vaccines in the curative treatment of coryza. On the other hand, in serious cases in young babies with symptoms of dehydration, diarrhœa, and vomiting, there is a good deal to be said for intravenous transfusions of convalescent serum, if such can be obtained from a convalescent member of the family who has already had the same infection. In those cases in which convalescent serum cannot be obtained, ordinary " grouped " blood, or blood plasma, has definite value, both as a food and as a curative agent.

Gonococcal Rhinitis.

This is a serious condition which may escape diagnosis unless a swab is taken. Like gonococcal ophthalmia neonatorum, it generally commences on the 3rd or 4th day after infection has taken place. The discharge is profuse, and sometimes blood-stained. Breathing is snuffling, as in syphilitic rhinitis. The eyes are sometimes also involved.

Treatment. Thorough irrigation of the nose with a 1 per cent solution of mercurochrome, which may be instilled into the nose by means of a dropper, with the infant inverted or the head tilted back, so that the lotion may reach the upper areas of the nose, including the nasal sinuses.

The eyes should be treated prophylactically, with 2 drops of acriflavine in castor oil (1 in 1500), or if already involved, by the method described on page 160.

Syphilitic Rhinitis (Snuffles).

The term " Snuffles " is properly reserved for cases of syphilitic rhinitis in babies, but in practice it is employed to cover all cases of acute inflammation of the nose with snuffling respirations, and muco-purulent discharge. I once met with a case in which a diagnosis of syphilis had been incorrectly made and treated as such merely because the baby had developed a severe rhinitis

with muco-serous discharge during the first few weeks of life. Untreated cases of syphilitic rhinitis pass into a chronic condition, with ulceration of the mucous membrane, broadening of the bridge, and later in life a " saddle " nose.

Treatment. If the ordinary systematic treatment described for congenital syphilis (see page 161) is applied, the local condition of the nose soon clears up, but pending this happy consummation, local treatment should be undertaken in the early stages, and should consist in twelve-hourly douching of the nose with glycothymoline lotion (1 in 8), and occasional spraying with a 1 per cent solution of mercurochrome. In the later atrophic stages, with possibly involvement of bone and cartilages, the nose should be sprayed with a solution of neo-protosil, by means of a good nebulizer, and any existing crusts or sloughs removed.

Chronic Rhinitis

Since a chronic rhinitis may result from any long-standing or untreated case of acute rhinitis, the etiology and pathology of chronic cases are necessarily very much the same as those of the acute form, but in the majority of cases of chronic rhinitis it will be found that the inflammatory process which possibily in the acute form is confined to the nasal chambers proper, will have extended to the accessory sinuses—the antrum, the sphenoid, the ethmoid, or the frontal—blind cavities or *cul de sacs* which are difficult of drainage, and almost beyond the reach of local treatment of any kind.

Some believe that a considerable proportion of cases of chronic rhinitis are complicated by the co-existence of some form of sinusitis, and that a cure of the former is not likely to be effected until the sinusitis has itself been cured, and I must admit that I am largely of the same opinion. Many cases of chronic rhinitis are however so closely involved with such conditions as deflexion of the septum, nasal polypi, tonsils, and adenoids, that the possibility of all such complications must be taken into consideration in the treatment of rhinitis itself.

It is usual to classify chronic rhinitis in two categories :

1. Hypertrophic chronic rhinitis.
2. Atrophic chronic rhinitis.

The latter again being subdivided into simple and fœtid (Œzena) varieties.

1. Hypertrophic Chronic Rhinitis. This group includes the familiar " runny nose " or sniffling type of rhinorrhœa, met with in almost every class-room in elementary schools. Many of these

children are never free from what is called "a cold," although they are liable to definite exacerbations. They often have the "adenoid facies," while again others have narrow noses, small nostrils, and high palates. Such children are almost invariably operated on for "tonsils and adenoids," sometimes more than once, with very unsatisfactory results. The chronicity of these cases depends on the underlying or associated cause, namely, a sinusitis, deflected septum, narrow nose or hypertrophied turbinates. Such cases cannot be cured by simple removal of the adenoids and tonsils, nor by the institution of breathing exercises.

Treatment. This must be directed to the underlying and associated conditions: sinusitis (see page 235): deflected septum (see page 232): narrow anterior nares (see page 599): or general susceptibility to infection.

The local condition is best treated by persistent and painstaking nasal douching, with some simple antiseptic lotion such as glycothymoline (1 in 8), and in accordance with the technique described on pages 231 and 242. Combined with this the nostrils should be sprayed once or twice a day with a nebulizer containing adrenalin, ephedrine, chloretone, and benzocain, elegantly combined in adrephine inhalant (P. D. & Co.), or by inserting into each nostril at night a small quantity of eucalyptus and boracic ointment (see page 700).

Attempts to raise the resistance of the child against infection by autogenous or stock vaccines are not as a rule very successful. Better results are got from the administration of cod-liver oil and malt, or by the giving of vitamins A and D in the form of adexolin, minims 5, three times a day.

2. Atrophic Rhinitis. (*a*) *Simple.* This condition is fortunately rare in children, especially among boys. It generally follows as a sequel to an ordinary acute rhinitis.

The secretion tends to become dry within the cavity of the nose, with the formation of crusts. Through the shrinking of the mucous membrane the cavities of the nasal chambers are enlarged. The mucous membrane appears glazed and shiny in such parts as are neither covered with crusts or bathed in purulent discharges. The more intractable cases are sometimes due to syphilis.

Treatment. This is best carried out by the frequent douching of the nasal chambers with some simple alkaline collunarium such as Borol (P. D. & Co.) diluted with three parts of warm water. The douching should be carried out with the child lying in the recumbent position, so that the lotion can flow freely into the naso-pharynx, whence it can be got rid of by swallowing or spitting.

At night time a small quantity of ointment of eucalyptus and boracic acid (see page 700) can be inserted into each nostril, whence it gets distributed fairly widely over the nasal mucous membrane.

(*b*) *Fœtid Atrophic Rhinitis, or Œzena.* This condition is rare in childhood, and almost unknown among infants. It is usually the sequel of an acute suppurative rhinitis, but the possibility of syphilis must not be forgotten.

Treatment. The offensiveness of the breath in œzena is best treated by frequent douching with a solution of peroxide of hydrogen (10 vols.) diluted three or four times with warm water. In between times the nasal cavities may be sprayed with some simple oily nebula, such as Paroleine Spray Compound (B. W. & Co.). The occasional substitution of neo-protosil is useful, but a toxic preparation of this kind is not advisable in so chronic a condition as œzena, in which frequent application is required. At night-time a small quantity of some simple antiseptic preparation such as boracic ointment, or eucalyptus and boracic ointment (see page 700) is of value. Thyroid treatment has been advised by some authorities, but it does not appeal to me, as its use does not appear to be founded on any rational basis.

Sinusitis

The accessory sinuses of the nose are poorly developed in infants at the time of birth, with the exception of the ethmoidal, in which a few of the anterior cells are present, and the antra which are definitely present, but of small size. The sphenoidal sinuses do not appear until the 5th year, nor the frontal until the 6th year.

It might be supposed from their small size that the sinuses in childhood would not often be involved, but this is by no means borne out by post-mortem evidence. A considerable number of the ethmoidal cells are found to contain pus at autopsy, and not a few of the antra, in cases of children who have died from influenzal and other catarrhal infections. Hollow cavities, such as those of the middle ear, and of the accessory sinuses of the nose are very badly drained, and are ideal situations for the development of pyogenic organisms with chronic inflammatory results.

Acute Sinusitis.

With acute catarrhal infections of the nose in children, lasting more than a few days, it is very improbable that the accessory sinuses will escape infection. In antral disease the malar area of the cheek is generally swollen, and the œdema may involve

the lower eyelid. The point of maximum tenderness is immediately above and lateral to the nasal ala, and on endoscopy, pus or muco-purulent discharge will be seen to travel along the inferior turbinate towards the naso-pharynx.

In the case of ethmoidal sinusitis headache is frequent and the pain is generally frontal. The discharge generally takes the same direction as in the case of antral disease. Acute cases in infants with inflammation at the internal angle of the eye are almost certain to be cases of infective osteo-myelitis.

Treatment. *Prophylactic.* The prophylactic treatment is the same as that for the prevention of ordinary colds, *i.e.* the avoidance of infection, good hygienic conditions, and the raising of resistance to infection.

Curative. The curative treatment is not very satisfactory. Hot fomentations may be applied externally, and the interior of the nose may be syringed with water or normal saline as hot as can conveniently be borne. The child should be made as comfortable as possible by sedatives, such as Aspirin 1 gr. or Somnosal 1 gr. at night time. If the external redness and swelling persist for more than 3 days, surgical interference is advisable.

The complications which are to be feared are orbital or peri-orbital cellulitis, thrombosis of the cavernous sinus, septicæmia, meningitis, or cerebral abscess.

Chronic Nasal Sinusitis.

This condition is probably far more common than is usually supposed, and may be assumed to coexist, at any rate in some degree, in all cases in which there are persistent and repeated colds in the head.

The special symptoms attributable to chronic sinusitis are headaches, pyrexias, sallowness of complexion, and other effects attributable to a septic absorption and general toxæmia. Endoscopy may reveal the presence of pus tracking along the turbinates, and in long-continued cases polypi may be discovered in the middle meatus. Adenoids and enlarged tonsils are also more likely to be the results than the causes of a chronic sinusitis.

Treatment. The treatment is the same as that for acute sinusitis. The evacuation of the contents of the inflamed sinuses is not always easy in the case of children. Antra may be drained by making an opening through the inferior meatus, while the Proetz's displacement method of suction, and the filling of the sinuses with a $\frac{1}{2}$ per cent solution of ephedrine and normal saline, is sometimes very effective. All cases of chronic sinusitis which fail to respond to simple methods of treatment must be regarded as serious and should be submitted for expert advice.

Nasal Polypi

Polypi may develop within the interior of one of the nasal sinuses, usually the antrum, or may grow from the lips of the semi-lunar hiatus under cover of the middle turbinate. They are uncommon in children under 5 years of age. They are nearly always secondary to a chronic sinusitis. The symptoms are nasal obstruction, sniffling breathing, loss of sense of smell, nasal tone of voice, and hæmorrhage. They are often visible without the aid of a rhinoscope, filling up the cavity of the nose.

The treatment is surgical, with avulsion of the roots, and not by amputation. The operation should be done under a general anæsthetic. There must be independent treatment of the underlying sinusitis.

Hay Fever

(Hay Asthma, Spasmodic Rhinorrhœa, or Allergic Rhinorrhœa)

The term " Hay Fever " should properly be reserved for those exceptional cases in which a paroxysmal rhinorrhœa is caused during the months of May and June in Britain by the specific effect of the pollen of grasses acting on allergic subjects. Thus limited in its etiological definition, hay fever is almost unknown in infants, and is very rarely met with in older children before they are 8 years of age.

In its more popular interpretation, the term hay fever covers a great variety of forms of paroxysmal rhinorrhœa due to other irritants associated with the emanations from cats, dogs, horses, plants, flowers, etc. Under this extension of the term, hay fever can occur at any age, even in quite young infants.

Treatment. Palliative treatment consists in the wearing of smoked glasses, and the application of the following ointment to both eyes and nose :

Benzocain	1 drachm (3·5 gm.)
Ephedrine Hydrochloride	5 gr. (0·3 gm.)
Solution of Adrenalin-Hydrochloride (1 in 1000) .	½ drachm (1·75 c.c.)
Soft white paraffin to make 1 oz. (30 c.c.)	

and internally, $\frac{1}{10}$ grain (0·006 gm.) ephedrine hydrochloride may be given by the mouth : or in very acute cases 1–2 minims (0·06–0·13 gm.) of a solution of adrenalin hydrochloride (1 in 1000) may be given hypodermically.

Desensitization may be carried out by the method described (see page 720).

THE PHARYNX

Acute Pharyngitis

Acute Pharyngitis may be sub-classified as :

1. Acute Simple Pharyngitis.
2. Acute Septic Pharyngitis.

1. Acute Simple Pharyngitis.

This is one of the commonest pathological troubles to which childhood is prone. The ordinary " cold " generally takes the form of an acute pharyngitis in combination with acute rhinitis, sometimes one, sometimes the other predominating.

Some of the acute general infections such as measles, influenza, and rheumatism, at times commence with an acute pharyngitis ; in fact it is generally impossible to say how or where an acute attack will end, and for this reason it should never be regarded lightly, or treated in a perfunctory manner.

The etiological significance of an acute pharyngitis, and its association with enlarged tonsils and adenoids, will be considered at some length in the section which deals with chronic pharyngitis (page 239), and to this the reader is referred.

Treatment. *Prophylactic.* This consists in maintaining the child's resistance to infection by good feeding, open-air treatment, and other hygienic measures. Vitamin therapy, especially as regards vitamin A, is of use, and preventive inoculation with anti-catarrhal vaccines, though not always effective, is certainly worth trying in the case of susceptible subjects. The avoidance of exposure to infection—an obvious precautionary measure, is rather a " counsel of perfection," but the sucking of antiseptic lozenges, such as Formamint or Monsol, or spraying, douching, or gargling, with an antiseptic lotion made by dissolving one Nasoral tablet (P. D. & Co.) in 4 oz. of water, are precautionary measures worth while taking if there has been exposure to any known source of infection and the child is old enough to co-operate in the treatment.

Curative. It is not possible to abort an ordinary pharyngitis, or influenzal cold, if, however, prompt measures are taken it is possible to mitigate the severity of an attack by the same means which are recommended in the case of a commencing acute rhinitis (see page 230), and the subsequent treatment should be conducted on the lines there recommended.

2. Acute Septic Pharyngitis.

Although possibly there is no definite line of demarcation between a simple and a septic acute pharyngitis, there is very

considerable difference between a really bad attack of the latter and a mild one of the former—the difference depending on the specific character of the infective organism and its degree of virulence. With a severe attack of septic pharyngitis, with high temperature, constitutional symptoms, and enlarged cervical glands, the condition is nearly always serious and due to a streptococcal infection, and more often than not of the hæmolytic type.

Serious forms of septic pharyngitis are associated with diphtheria, enteritis, erysipelas, measles, scarlet fever, and smallpox, although even in those cases the infection is generally a mixed one, with a predominance of a hæmolytic streptococcus. I always think the differential diagnosis between a septic membranous pharyngitis and a true diphtheria one of the most difficult propositions with which a practitioner can be faced. The clinical and local evidence may be all in favour of a diphtheritic infection, and yet the bacteriological report may be entirely negative as regards the presence of K.L.B.

Treatment. Under such conditions, although rational treatment obviously points to specific serological therapy, the possibility of a mixed infection must not be lost sight of. Vincent's angina, although generally confined to the tonsils, may also pervade the pharyngeal wall and present difficulties in the diagnosis. In all cases a throat swab should be taken and submitted to bacteriological investigation, and pending the arrival of the report the throat should be well painted or sprayed with some efficient antiseptic, such as Mandl's Paint (Pigmentum Iodi Composition), or Paroleine Spray Compound (B. W. & Co.) or Liquor Hydrargeri Perchloridi (B.P.) 1 part to 3 parts of glycerine.

The serological treatment must be directed to deal specifically with the organism identified, whether this be streptococcal, pneumococcal, or diphtheritic, for which special anti-toxic sera are available.

Chronic Pharyngitis

Chronic infection of the naso-pharynx leads to a condition which is generally known as enlarged tonsils and adenoids, or for short—" T's and A's." Since these conditions and their various consequences are among the most common of the ills of childhood, they will be dealt with at some length.

Enlarged tonsils and adenoids represent the hypertrophy of the lymphatic tissue of which the tonsils and pharyngeal wall are largely composed, and this hypertrophy is the result, in compliance with one of the fundamental laws of physiology, of the

excessive exercise of the specific functions of these structures. The main function of lymphatic tissue is to destroy bacteria, in other words, to protect the system from infection. When any individual is exposed to invasion by pathological organisms the lymphatic tissue affords one of the first barriers of defence, and the degree to which this lymphatic tissue will hypertrophy will largely depend on the amount of work it has to do.

The naso-pharynx is exposed to bacterial invasions almost more than any other part of the body, and its mucous membrane has to bear the brunt of the attack. It is in fact one of the chief danger zones of the body, and in consequence it is well provided with lymphatic tissue. The efficiency of the bactericidal functions of the lymphatic tissue will play some part in the determination of the degree of the hypertrophy. Lymphatic subjects, with poor bactericidal powers have to develop larger tonsils and more adenoids than children who are more resistant.

Quite apart however from the varying degrees of immunity to infection with which different children are endowed by reason of the bactericidal powers of their lymphatic tissues, the local anatomical conditions of the naso-pharynx play a very considerable part in the efficiency of the defence. The two factors which mainly influence the suitability or the reverse of these spaces for harbouring and developing bacteria, are firstly, the efficiency of the drainage, and secondly, the efficiency of the ventilation. Bad drainage and bad ventilation favour the incubation of bacteria, while good drainage and good ventilation keep it under some control.

Many infants are born with congenital abnormalities of the palate which limit the floor space of the nasal chambers, and it must be remembered that the roof of the mouth is the floor of the nose. With a contracted or highly arched palate, the floor of the nose will also be encroached upon, and the space or air-way between the septum of the nose and the turbinates will be correspondingly restricted. An infant with small and narrow nostrils and restricted air-way can only breathe with difficulty *per vias naturales*, and will almost certainly take the path of least resistance and breathe through the mouth, especially under conditions in which, through congestion of the nasal mucous membrane, the air space in the nose is still further restricted. The habit of mouth-breathing may thus be easily acquired in early infancy, and with mouth-breathing the opportunities for drainage and ventilation in the nasal and post-nasal spaces will be unfavourably affected. On the other hand, favourable conditions will be provided for the accumulation of mucus, and for

the incubation of bacteria. With the multiplication of bacteria in these situations, there will follow hypertrophy of the protective lymphatic tissue, and the development of enlarged tonsils and adenoids.

In accordance with this view of the etiology of at least a certain proportion of cases of tonsils and adenoids, the latter must be regarded more as the result than the cause of mouth-breathing. Later on a vicious circle will clearly be established in that with the development of tonsils and adenoids nasal breathing is rendered still more impossible, and with mouth-breathing appropriate conditions are provided for the further development of tonsils and adenoids. This possible explanation of the essential etiology of certain cases of tonsils and adenoids is not in the least at variance with the views that are widely held with regard to their causation in the generality of instances, namely, that they are due to the frequent contraction of "Common Colds," to bad feeding, cold and damp climates, to overcrowding, bad housing, bad ventilation, hereditary tendencies, dental caries, and a general septic condition of the mouth. I do not claim that the only or chief cause of tonsils and adenoids is contraction of the air space in the anterior nares, but that this is a very important etiological factor in a number of cases, which must be taken into serious consideration, both in the prevention and in the cure of these pathological neoplasms. It is perhaps unnecessary to mention here the many common sequelæ of tonsils and adenoids —it may be sufficient to refer to two of the more serious of them, namely, blockage of the eustachian tubes predisposing to otitis media, and deformities of the chest leading to pulmonary complaints of various kinds and degrees.

Treatment. *Prophylactic.* The steps taken to prevent tonsils and adenoids will clearly depend on the view one takes of the etiology. If one can assure oneself that the development of these lymphatic hyperplasias is mainly due to congenital defects in the structure of the nose which interfere in the first place with normal nose-breathing, and secondarily with the ventilation and drainage of the nasal cavities, one is obviously faced with a very difficult task in finding a suitable means of prophylaxis. Neither is it easy to break a habit of mouth-breathing when such a perversion has once been contracted. But whatever view is held of the etiology, it is clear that one very important factor in the prevention of tonsils and adenoids must be to avoid the establishment of the habit of mouth-breathing in young infants, and it must be remembered that a very much larger number of new-born infants acquire this habit than is usually suspected.

Even though new-born infants can breathe quite easily through the nostrils, they may find it still easier to breathe with the mouth open, and if they do so a permanent habit of mouth-breathing is very easily engendered. For this reason careful supervision should be exercised to encourage nose-breathing and to discourage mouth-breathing. At birth the nose is frequently flattened, and the nostrils are often blocked with mucus, and under these conditions it is quite understandable that the infant will select the path of least resistance and breathe with the mouth open, but such a habit can easily be prevented if the nasal passages are cleared of mucus, and opening of the mouth prevented by the application of a bandage carried under the chin and over the apex of the head.

Other points in the prophylaxis are firstly, the prevention of infection of the naso-pharynx, and the subsequent development of rhinitis, pharyngitis, and sinusitis, by appropriate hygienic measures, such as good feeding, proper housing, ventilation, clothing, etc., and by the avoidance of all those conditions which predispose to the contraction of the " Common Cold." Secondly, by efforts to raise the resistance to infection, by specific serological methods, vaccines and vitamin therapy. Thirdly, by attempts to improve the post-nasal ventilation and drainage by deep breathing exercises, if these are possible, by teaching the child how to blow the nose, and by irrigation of the nasal air-passages.

Of all the prophylactic measures that of nasal irrigation is to my mind the most effective. The nose of the baby, and it does not matter how early the treatment is commenced, should be douched twice daily by dropping some simple antiseptic lotion such as glycothymoline (1 in 8) into the nostrils, and allowing it to flow along the floor of the nose, so that it reaches the naso-pharynx, and either returns through the other nostril, or passes into the back of the mouth and is swallowed. To carry out this procedure properly, the infant must lie in the recumbent position, and the tip of the nose must be elevated by the operator so as to open up the nostrils, and allow the easy entrance of the fluid.

It is not only unsatisfactory, but it is actually harmful to attempt to irrigate the upper chambers of the nose in the neighbourhood of the accessory sinuses by introducing the collunarium by means of a syringe. The fluid should be allowed to flow by the force of gravity to the back of the pharynx. It is quite easy to douche the nose of quite young babies in accordance with the above method, if the amount of fluid used is very small at first, and only increased drop by drop as the infant gets accustomed to the treatment.

Curative. When once the tonsils have become chronically enlarged, or when the adenoids have become permanently developed, they may shrink in the course of time by a process of fibrosis, but they will never return to their original healthy condition. They will be imperfect instruments for the prevention of infection. Whether tonsils and adenoids should be removed by operation or whether attempts should be made to treat them by palliative means, depends very largely on whether or no they have been permanently damaged and are thus unable to carry out their normal functions, and also on whether by their presence they are an actual menace to health by interfering with the normal respiratory functions. If tonsils contain foci of infection, and if their failure to do their work is demonstrated by the presence of enlarged cervical glands, or if the eustachian orifices have already been occluded by the development of adenoidal growths, with threatening otitis media, there can be no question that a surgical operation for their removal should be undertaken. If an operation is decided on the tonsils should be enucleated and not shaved off, as is occasionally their fate. If once removed they cannot grow again, although at times adenoids recur even more than once after operation. Subsequent to operation the child should, if old enough, be taught deep breathing exercises, but it cannot be too strongly emphasized that such exercises are not only useless, but actually harmful, if there is sufficient stenosis of the anterior nares to prevent easy breathing *per vias naturales.* Those who operate for tonsils and adenoids should always make certain that the primary trouble does not consist in occlusion of the anterior air spaces of the nose, by hypertrophied turbinates, deflected septum, or contracted palate.

Tonsillitis

Acute Tonsillitis.

This condition, like acute pharyngitis, with which it is often associated, may be secondary to rhinitis, sinusitis, or dental caries, or it may be a prodromal symptom of rheumatism, measles, or scarlet fever, or as is more usually the case, it may represent the flare-up of a chronic septic condition of the tonsils, or of the mouth, or the beginning of a " common cold." There are several varieties :

1. General parenchymatous inflammation.
2. Acute follicular infection.
3. Ulcerative inflammation (Vincent's Angina).
4. Abscess of the substance of the tonsil.
5. Peritonsillar abscess or quinsy.

Treatment. *Prophylactic.* The same as in acute pharyngitis (see page 238).

Curative. With acute tonsillitis children usually have serious constitutional symptoms, with high temperature, headache, anorexia, and vomiting. They are in fact suffering from an acute septic infection. If the attack lasts more than a week it generally means that an abscess is forming.

Although specific serological treatment is obviously the rational method to adopt, parents do not as a rule appreciate such drastic measures for a condition which they may regard as an everyday event, and of no great importance, and for this reason the practitioner will usually be better advised to adopt simple palliative methods. Although salicylate of soda, or aspirin are the usual remedies advised, I have had better success with hydro-bromate of quinine, which seems to relieve the headache and induce sleep better than any other form of treatment, especially if it is preceded by a preliminary dose of phenacetin. For a child 1 year of age, 1 gr. of phenacetin is sufficient, followed by four-hourly doses of the following:

Hydro-bromate of Quinine . . .	1 gr. (0·06 gm.)
Dilute Hydro-bromic Acid . . .	2 minims (0·13 c.c.)
Simple Syrup	½ drachm (1·8 c.c.)
Chloroform water to make . . .	1 drachm (3·5 c.c.)

Dose for a child 1 year of age 1 drachm three times daily.

The child will naturally be confined to bed during the acute stages of the fever, and during this time owing to painful swallowing, the feeding will be difficult. Cold jellies, grapes, and other cold and slippery forms of food will be better tolerated than the usual invalid foods.

Vincent's Angina.

In this condition the tonsils should be painted at frequent intervals with Mandl's Paint (Pigmentum Iodi Compositum) and 0·1 gm. of Sulfarsenol injected hypodermically. This seems to have a specific action on the spirochæta denticola, which with the bacillus fusiformis constitutes the flora of the usual mixed infection in Vincent's Angina.

Peritonsillar Abscess.

The abscess always opens itself, but the great relief which ensues from the evacuation of the pus can be expedited when the abscess is ripe by pushing the point of a sinus forceps into the presenting part, or at that point on the soft palate where the swelling is at a maximum, and opening the blades in the interior of the abscess.

THE LARYNX

Congenital Affections of the Larynx

Webbing of the Cords. A rare malformation of the larynx is the matting together of the anterior portion of the cords by means of a membranous webbing. The extent to which this condition interferes with respiration, and the severity of the symptoms in general, depend on the extent to which the posterior portions of the cords are left free and unfettered.

The symptoms are dyspnœa, retraction of intercostal spaces, stridor, and attacks of cyanosis. The cry is hoarse and feeble. The diagnosis is usually not difficult, but laryngoscopic confirmation requires the administration of an anæsthetic.

The treatment is the separation of the webbing after preliminary tracheotomy.

Congenital Laryngeal Stridor. It is perhaps open to question whether this condition should be included among developmental defects. By some, myself included, it is regarded as due to a lack of co-ordination in the nervous control of the muscles which are concerned in the movements of the epiglottis and associated structures. This functional origin is rendered all the more probable owing to the fact that the stridor is by no means always permanent, and that as a rule anatomical malformations of the upper orifice of the larynx are not demonstrable unless the condition has existed for some length of time. The stridor is caused by the sucking in of the aryteno-epiglottidean folds into a narrowed glottis. There appears to be some lack of rigidity in the walls of the superior aperture of the larynx. The stridor consists of a high-pitched crow on inspiration : expiration is quiet. There is considerable retraction of the intercostal spaces, which may in time lead to thoracic deformity. There is as a rule no cyanosis, and no distress. The stridor often ceases during sleep.

The character of the noise can usually be altered by external compression of the upper part of the larynx, applied with the fingers encircling the neck. It can also be altered or even made to cease by the pulling of the tongue forward. I have on more than one occasion noticed what appeared to be an identical condition, though temporary, in new-born babies, when labour has been conducted under deep anæsthesia. This temporary stridor can usually be controlled by pulling the tongue well forward with tongue forceps, or by traction on a thread passed through the tip of the tongue, and it has occurred to me that congenital

stridor may perhaps in all, or most, cases be due to the acquisition of a perverted habit, or conditioned reflex, due to some disturbed innervation of the larynx present at the time of birth. If I am right in this view, the treatment of the condition must be mainly prophylactic, that is to say, stridor arising immediately after birth must be controlled by pulling the tongue forward, before it becomes a permanently fixed habit (see also page 249).

Acute Laryngitis

Acute affections of the larynx are mainly of an inflammatory character, such for instance as acute catarrhal laryngitis, and acute membranous laryngitis (diphtheria). Others are spasmodic, and chiefly nervous in origin, as laryngismus stridulus, or laryngitis stridulosa, while acute œdematous angio-neurotic œdema, one of the most alarming of all acute conditions of the larynx, is neither inflammatory nor nervous, but an example of an allergic reaction to some circulating re-agent in a specifically sensitized subject.

The term " *Croup* " which was formerly used so frequently in connection with acute laryngeal affections, is a much-abused term, which means very little, and which would be better deleted from medical literature. The term was formerly used to cover a group of acute symptoms of the larynx, among the more important of which were hoarseness, inspiratory stridor, cough, dyspnœa, and recession of the thoracic wall. The term " true croup " was reserved for cases of simple catarrhal or membranous laryngitis, while the term " false " or spasmodic croup was applied to laryngismus stridulus and laryngitis stridulosa.

Acute Catarrhal Laryngitis

This condition generally represents an ordinary cold which in predisposed subjects involves the larynx in an acute inflammation. It may however be an early symptom of measles, whooping-cough, influenza, scarlet fever, or enteric fever. There is always hoarseness, pain on talking, crying or coughing, and some degree of pyrexia.

Treatment. *Prophylactic.* Preventive treatment consists in the avoidance of cold air, dampness, or other conditions which lead to chill, in fact in avoidance of all the predisposing causes of the " Common Cold."

Curative. The child must be kept in bed in a warm well-ventilated room. The diet should be low, but ample supplies of warm beverages, such as black-currant tea or lemonade may be taken. Heat should be applied externally to the larynx in the

form of compresses, stoups, poultices, or Antiphlogistine. The child should be placed in a tent, or under a properly adjusted canopy, with a bronchitis kettle to the water in which ½ oz. Friar's Balsam has been added.

As for drugs, the treatment should always start with a simple aperient, such as 1 drachm of Compound Syrup of Figs. An old-fashioned remedy for so-called "Croup," was to give a full dose of Antimonial Wine, and I am not sure whether it is not as good or better than any of the more modern remedies. To be effective it should be given in almost emetic doses, and it may well be combined with ipecacuanha wine, citrate of sodium, iodide of potassium, and opium. The following prescription is for a one-year-old baby.

Antimonal Wine	5 minims (0·3 c.c.)
Ipecacuanha Wine	5 minims (0·3 c.c.)
Citrate of Soda	10 gr. (0·6 gm.)
Tincture of Camphorated Opium .	2 minims (0·13 c.c.)
Iodide of Potassium	1 gr. (0·06 gm.)
Glycerine	10 minims (0·6 c.c.)
Chloroform water to make . .	1 drachm (3·5 c.c.)

One dose to be taken every 4 hours.

Acute Membranous Laryngitis (Diphtheria).

This condition demands specific serological treatment, and will be dealt with in the section on diphtheria (see page 414).

Laryngitis Stridulosa

(Laryngeal Spasm, Spasmodic Laryngitis, Spasmodic Croup)

It is an open question whether this condition is an independent disease entity, or merely a special form of acute laryngitis, occurring in nervously disposed children, generally over 2 years of age. It represents indeed the type of attack to which formerly the name "Croup" was given. The usual sequence of events is that the child in the first instance shows mild symptoms of an ordinary cold, with perhaps a little hoarseness, cough, and pyrexia. Shortly after going to bed he becomes restless, and if he falls asleep he suddenly wakes up struggling for breath, with loud inspiratory stridor and dyspnœa. He is generally very frightened, breaks into a profuse perspiration, and shows signs of exhaustion. At the acme of the attack, the spasm of the larynx relaxes, the crisis is over, and the child falls into a peaceful sleep.

Although similar attacks may be repeated during the night, on the following day the child appears perfectly well, without any laryngeal symptoms, although he may have a little cold.

The difference between these attacks and those of ordinary acute

catarrhal laryngitis is a very narrow one, and mainly consists in the absence of laryngeal symptoms between the acute crises, and they differ from those of laryngismus stridulus in that in the latter condition the child is usually considerably younger, between 6 months and 2 years, and because in the latter condition other symptoms of spasmophilia or rickets also exist.

Treatment. *Prophylactic.* The treatment should be directed to the general nervousness of the child, by the exhibition of bromides, lactate of calcium, glycero-phosphate of calcium, and alkalies, and also by avoiding all those conditions which predispose to the "Common Cold."

Curative. Speaking quite generally, the treatment is the same as that for acute catarrhal laryngitis, but the nervous element requires special attention. For the latter, during the acute symptoms, there is nothing better than a whiff of chloroform, which is as a rule immediately efficacious, as also is chloral hydrate to the extent of some 2 or 3 grains given by the mouth. The hypodermic injection of 3 minims of 1 in 1000 solution of adrenalin also has its advocates. For a more sustained effect, lactate of calcium and bromide of ammonia may be given in the following prescription:

Lactate of Calcium	10 gr. (0·6 gm.)
Bromide of Ammonium . . .	5 gr. (0·3 gm.)
Citrate of Sodium	10 gr. (0·6 gm.)
Chloroform water to make . .	1 drachm (3·5 c.c.)

One dose to be given three times a day.

Laryngismus Stridulus

This is one of the triad of symptoms of the spasmophilic state, the other two being tetany, and general convulsions.

This condition is invariably accompanied by a reduction in the concentration of the blood calcium, which may fall as low as 2 or 3 mg. per 100 c.c. of plasma. In conjunction with this there is also generally a fall in the blood phosphorus, which may be as low as 3 or 4 mgm. per 100 c.c. of blood plasma. A characteristic of the condition is the spasmodic closure of the glottis, which occurs intermittently, and lasts from 5 to 15 seconds, and terminates in a long-drawn inspiratory crow.

Treatment. *Prophylactic.* This consists in all those measures which are directed to the prevention of spasmophilia (pages 559 and 699), and mainly depends on the adequate supply of vitamin D, and lactate of calcium, or calcium in some other available form, in fact, in all important points the prophylaxis of laryngismus stridulus is the prophylaxis of rickets.

Curative. For an acute attack, the treatment is the same as that for laryngitis stridulosa, or for catarrhal laryngitis. A whiff of chloroform, or 3 grains of chloral hydrate is rapidly effective. External heat may be applied to the larynx, as in the case of catarrhal laryngitis, and inhalations of steam with Friar's Balsam may be given. For the more sustained treatment 10 minims (0·6 c.c.) of Radiostol solution (B. D. H.) with 10 grains (0·6 gm.) of lactate of calcium, should be given three times a day. The old-fashioned Viennese treatment, consisting of phosphorus dissolved in cod-liver oil, cannot in my opinion be bettered by any of the modern methods of vitamin therapeusis ; either the phosphorus, or the cod-liver oil, or the two combined, seem to have some specific influence on the spasmophilic manifestations which cease in a comparatively short time after administration of this medicine. In the old days before the discovery of vitamins, I used this method exclusively, and never remember to have had a failure. The following is the prescription (see page 699) :

Phosphorus (1 in 4000) in Cod-liver Oil.
One drachm to be taken three times a day.

Congenital Laryngeal Stridor

This condition in mild form is common in new-born babies. It appears to be due to inco-ordination in the muscles of the glottis and epiglottis, whereby the latter is sucked into the superior aperture glottis, in the act of inspiration, imparting a crowing sound to respiration. The symptom is supposed by some to be due to a peculiarity in the anatomical relationship of the structures involved, and the trick or perverted action of the muscles concerned becomes very firmly established and persistent. As a rule however the symptom ultimately disappears.

Treatment. *Prophylactic.* Since the symptom as a rule only arises when the breathing is rapid or deep, the baby should be disturbed as little as possible for feeding or other purposes during the first few days of life.

Curative. Pull the tongue well forward, and encourage sleep as far as possible by bromide or other sedatives : avoid everything which encourages physical exertion on the part of the baby.

Chronic Laryngitis

This condition is very rare in children under 5 years of age, and rarer still in infants under 1 year. It may however occur as a sequel to an acute attack, as a result of a syphilitic or tuberculous infection, or as secondary to "T's and A's," sinusitis, or nasal catarrh. The symptoms are hoarseness, and a barking cough.

Treatment. Treatment in the first instance must be directed to the primary cause. The local treatment consists in inhalations of steam impregnated with benzoin (½ oz. of compound tincture of benzoin to 1 pint of boiling water), or Chloretone inhalant (P. D. & Co.) given by means of a nebulizer (Glaseptic : P. D. & Co.).

Tuberculous Laryngitis

This is a very rare and insidious disease. It is difficult to diagnose in young children. There is generally hoarseness of voice, and loss of tone, with some redness and swelling of the arytenoids, with possibly a greyish deposit.

Treatment. The treatment is that of the primary condition (see page 440). Local treatment consists in rest to the larynx by silence or whispering only. Chloretone (P. D. & Co.) or a sedative spray may be given by a nebulizer. Puncture by means of the galvano-cautery [1] is sometimes effective.

Syphilitic Laryngitis

This is extremely rare in young children, except in the semi-acute cases which accompany "snuffles." It may take one of various forms, such as chronic catarrh, diffuse gummatous infiltration, perichondritis, or ulceration.

Treatment. The general treatment is that of the underlying disease (see page 444). Local treatment is that of chronic laryngitis (see page 249).

Paralysis of the Vocal Cords

This is a very rare condition in infancy and early childhood. It may be due to post-diphtheritic neuritis, encephalitis, or syringo-bulbia. The hysterical variety practically never occurs in young children.

Treatment. The treatment is that of the primary condition.

Foreign Bodies in the Larynx

The symptoms are sudden dyspnœa, choking, cyanosis, dysphagia, hoarseness, or aphonia. In the less severe cases these acute symptoms pass off as the larynx becomes tolerant of the presence of the foreign body, leaving behind some hoarseness and possibly a little coughing. The diagnosis of the presence of a foreign body after the acute symptoms have passed off can only be made by direct examination with a laryngoscope,

[1] Tovolgoi, D., *Zeits. f. Laryngol.*, April, 1929, p. 126.

or by means of X-rays, which however do not always reveal the presence of a foreign body by a shadow. For instance, celluloid substances may be impacted in the larynx without affording any X-ray evidence.

Treatment. The treatment of this accident as far as the practitioner is concerned is of an emergency order. In the presence of acute symptoms something must be done, or the child will inevitably die of suffocation. If the infant cannot cough up the foreign body unaided, it should be inverted and thumped vigorously on the back, or an attempt should be made to hook up the object with the finger. If all these attempts prove ineffectual, and the child shows signs of unconsciousness, drastic steps must be taken to save life. It may demand a considerable amount of moral courage on the part of the practitioner who has never performed a tracheotomy operation in his life, to do so at a moment's notice, but it may be some consolation to him to feel that a tracheotomy operation is usually out of the question, owing to the fact that the necessary instruments are probably inaccessible at the moment. On the other hand, an operation for laryngotomy can be done with an ordinary pen-knife. The following are the details of procedure :

Laryngotomy. Feel for the cricoid cartilage, and plunge the pen-knife boldly through the skin and subjacent cricoid-thyroid membrane transversely, immediately above the cricoid cartilage, and hold the wound open by a hair-pin or piece of wire. Such an operation allows of the entry of air, and gives time for the removal of the foreign matter from the larynx under an anæsthetic, which is usually necessary, and may be given later.

Acute Œdema of the Larynx

Acute œdema of the larynx sometimes occurs in children as a result of burns, scalds, trauma, wasp stings, or in association with diphtheria, erysipelas, measles, or typhoid. In specifically susceptible persons the taking of iodide of potassium may also have the same result. All of these are extremely rare exciting causes, and the treatment need not be discussed here, further than to say that in all cases of laryngeal œdema with definite dyspnœa, which do not yield immediately to the application of ice, external and internal, or to scarification, tracheotomy or intubation must be performed, or at least preparations must be made for such emergency operations.

On the other hand, angio-neurotic œdema of the larynx, although rare, is from the point of view of the pædiatrician an extremely interesting condition, and will now be considered.

Angio-Neurotic Œdema of the Larynx.

Œdema of the angio-neurotic type may occur in any part of the body, and is of the group of allergic diseases which includes asthma, urticaria, hay fever, etc., and is due to some inherent hypersensibility to particular antigens or other exciting causes. The attacks start suddenly from no apparent cause, generally at night-time, and the child is greatly distressed, dyspnœic, and cyanosed. On examination, a large smooth translucent swelling may be seen at the back of the throat, involving the epiglottis, the glottis, and neighbouring parts, and occluding the entrance to the larynx. It is a dangerous condition, and may cause death from suffocation unless tracheotomy or intubation can be promptly performed. The recognition of the condition is not as a rule difficult as the œdema is usually visible on examination of the throat, and is often accompanied by œdema of the face, or other parts of the body.

Treatment. *Prophylactic.* Since the precise etiology of this condition is not definitely known, we have no rational basis on which to found preventive treatment. Most pædiatricians believe that the attacks are due to allergic reactions to environmental factors, especially those of a dietetic nature, such as eggs, and fish, in fact that it is due to some protein hypersensibility, but there are clearly other causes, so that from the point of view of prophylaxis the most one can say is that the source of any possible exciting factor must be sought, and if found, avoided. If from skin tests or other means of inquiry, any enlightenment can be thrown on the precise nature of the exciting cause, there is evidently an opportunity for prophylactic treatment by the application of some appropriate desensitizing method (see page 720).

Curative. The treatment of this condition is clearly of an emergency nature. There is no time to apply slow-acting drugs or procedures. Ice must be applied externally to the neck, or if the child is old enough, it may be allowed to suck ice. Adrenalin to the extent of 3 minims of 1 in 1000 solution, or $\frac{1}{8}$ to $\frac{1}{4}$ of a grain of ephedrine hydrochloride, may be injected hypodermically, or the intravenous injection of 10 grains of gluconate of calcium may be tried. If none of these means succeed in relieving the symptoms intubation, tracheotomy or laryngotomy must be performed.

Scorbutic Eccymosis of the Larynx

This must be a very rare condition. I have only seen one case myself, and I can find no other in the literature, but it is

obviously an accident that may occur at any moment, for the larynx has no special immunity from hæmorrhage of the kind. As this case proved fatal, and it is the only fatal case of infantile scurvy that I have ever met with, it may be worthy of being placed on record. The infant was 16 months old, and had been fed on a highly scorbutic diet. It was brought to the Queen's Hospital for Children, suffering from what was thought at the time to be an acute attack of laryngitis with obstruction. There was respiratory stridor, dyspnœa, cyanosis, and great distress. When I saw the child 36 hours after admission I was able to make a definite diagnosis of scurvy, but it was too late to avert the fatal termination.

Treatment. The treatment for this condition, should it arise, is clearly the intravenous injection of ascorbic acid to the extent of 100 to 200 mgm. Administered in this way the ascorbic acid acts very rapidly, but since ascorbic acid suitable for intravenous administration is not likely to be immediately available, in the meantime the infant should be induced to drink freely of orange-juice in glucose solution. The juice of two to three oranges in the first 24 hours is not an excessive quantity.

New Growths of the Larynx

Neoplasms of the larynx are uncommon in young children, except papillomata, which may occur at any age. Symptoms of the latter are hoarseness, aphonia, dyspnœa, and cough, in an otherwise healthy child.

The diagnosis can be checked by direct laryngoscopical inspection.

The treatment is surgical and consists in removal of the growth.

THE TRACHEA

Congenital Malformations of the Trachea

Malformations of the trachea are rare, but the œsophagus sometimes communicates with it by a fistulous opening—a congenital condition which is not compatible with life.

Catarrhal Tracheitis

Apart from the irritative reflex cough, due to faucial and pharyngeal inflammation, tracheitis is in my experience by far the most common cause of cough in infancy and early childhood. It is usually loud, barking, and ineffectual, and of a type which is commonly described as a " graveyard " or " stomachic "

and as such is often ascribed to enlarged bronchial glands or indigestion. It is usually paroxysmal, and at times not unlike whooping-cough, which is itself essentially an inflammation of the trachea.

Tracheitis is one of the most frequent of the sequelæ of the common cold, or of influenza, and it results from a downward extension of the inflammatory process from the naso-pharynx. It is a very troublesome type of cough, slow to clear up, and frequently keeping the child awake at night. It is aggravated by cold air, deep breathing, and physical exertion. A severe tracheitis is almost invariably taken for a bronchitis, but may be distinguished from the latter by the complete absence of such physical signs as rhonchi, râles, and dullness in the chest, and constitutional symptoms. Moreover, a tracheal cough clears up more quickly than true bronchitis, and results in the expectoration of less sputum. But the most diagnostic evidence of tracheitis consists in the irritability of the trachea to external pressure applied with the finger just below the cricoid cartilage. With tracheitis a cough can always be elicited by pressure on this spot.

Treatment. *Prophylactic.* This is the same as that for the prevention of the " Common Cold," or influenza (see page 408).

Curative. Since a cough due to tracheitis is the type so commonly met with in early childhood, full details of the treatment are here appended. As in the case of bronchitis, so in that of tracheitis, the rational treatment must be made subservient to the stage of the infection, and the character of the secretion.

In the first stage there is little or no secretion, and the mucous membrane is red, congested, and irritable. Apart from the ordinary measures advised for the treatment of the common cold (see page 230), the rational treatment at this time consists in encouraging secretion and allaying irritability by :

(1) The external application of heat, and counter-irritation to the front of the neck by Antiphlogistine, or the old-fashioned remedy of a mustard plaster.

(2) The inhalation of steam, impregnated with compound tincture of benzoin (½ oz. to 1 pint of water).

(3) The administration of the following sedative expectorant :

Citrate of Soda	10 gr. (0·6 gm.)
Iodide of Potassium	2 gr. (0·13 gm.)
Camphorated Tincture of Opium	2 minims (0·13 c.c.)
Ipecacuanha Wine	5 minims (0·5 c.c.)
Syrup	½ drachm (1·8 c.c.)
Peppermint water to make	1 drachm (3·5 c.c.)

One drachm to be given every 4 hours.

During the second stage, which generally begins on the 2nd or 3rd day, the secretion is looser and consists of clear tenacious mucus. The rational treatment is to get rid of the sputum by a stimulant expectorant, and to allay the irritation which probably still persists by sedatives, as in the following prescription :

Compound Syrup of Cocillana (P. D. & Co.)	10 minims (0·6 gm.)
Camphorated Tincture of Opium	2 minims (0·13 gm.)
Peppermint water to make	1 drachm (3·5 c.c.)

One drachm to be given every 4 hours.

In the third stage, the mucous membrane of the trachea is denuded and raw, and the secretion is of a muco-purulent character. The rational treatment is to tone up the mucous membrane, to dry up the secretion, and to hasten recovery by a combination of balsams, and belladonna, as in the following prescription :

Compound "Elixoid" of Pine Tar (B. W. & Co.)	10 minims (0·6 gm.)
Camphorated Tincture of Opium	2 minims (0·13 gm.)
Tincture of Belladonna	3 minims (0·2 c.c.)
Syrup	10 minims (0·6 c.c.)
Peppermint water to make	1 drachm (3·8 gm.)

One drachm to be given every 4 hours.

General Treatment. This consists in keeping the child at an even temperature, and not allowing it to go out of doors till the cough has practically disappeared. The bowels must be kept well open, and a tonic treatment of cod-liver oil and malt, or bino-glycero-phosphates (A. & H.) 30 minims (1·8 c.c.) t.d.s. must be given in the final stages. As regards diet "over-calorying" must be avoided, though all the accessory factors, including minerals, must be given in adequate amount.

Foreign Bodies in the Trachea

Foreign bodies do not as a rule stay long enough in the trachea to give rise to much trouble, as they pass on into the bronchi, or are discharged into the larynx. Occasionally, however, sharp-pointed objects such as pins, brooches, fishbones, etc., become fixed in the tracheal wall and are difficult to dislodge. The symptoms in such cases usually take the form of violent laryngeal spasms, which may be succeeded by a period of relief if the object finds a more comfortable position in the trachea. This quiescent phase may obscure the diagnosis so long as the object remains in a safe position, but all the same it must be removed in order to prevent a recurrence of the laryngeal spasm.

During the quiescent period the child voluntarily indulges in very shallow respiratory movements, avoids laughing, talking, or coughing, so that the respiratory movements of the chest can hardly be detected. A characteristic position is usually assumed by the child in which the body is bent forwards and sideways, with the legs drawn up on the abdomen, a position which the child relinquishes with great reluctance.

Treatment. When once a definite diagnosis has been made by X-rays or other means, the object must be removed at all costs. It is difficult but not impossible in the case of infants and young children to remove a foreign body from the trachea by one or other of the ingenious instruments which have been devised for use with direct bronchoscopy. It is however a difficult operation which must only be undertaken under an anæsthetic by an expert.

DISEASES OF THE BRONCHIAL TUBES

Acute Bronchitis

What is commonly described as " Bronchitis " is often nothing more than a catarrhal condition of the trachea, with a loud barking cough, and but few constitutional symptoms. Again, recurrent attacks of asthma, with severe constitutional symptoms, pyrexia, and physical signs in the chest are sometimes mistaken for bronchitis, but the latter should be distinguished from both those conditions by the length of time which the attack lasts, and by the physical signs.

True bronchitis in infancy and early childhood is a serious condition, partly because the differences between it and capillary bronchitis or broncho-pneumonia, are only differences of degree and not of kind, and partly because catarrhal inflammation of the small tubes is very apt to terminate in chronic bronchitis, with thickening or fibrosis of the tubes, or in actual bronchiectasis.

Acute bronchitis can occur as an independent disease, especially when it takes the form of an acute exacerbation or recurrence of the chronic condition, but more frequently it represents an extension of a general inflammatory process from the upper air-passages, such as occurs in the case of an ordinary cold. It may also develop as a complication of whooping-cough, or some acute fever.

Treatment. *Prophylactic.*

The more we learn about the properties of vitamins, the clearer does it become that directly and indirectly they play an

important rôle in the prevention of various infections. Vitamin A, either alone or in association with other vitamins, undoubtedly exercises a very important influence in enabling the organism to resist infection. Vitamin A exercises some as yet unexplained action on the development and integrity of the epithelial cells of mucous surfaces such as those of the respiratory and alimentary system (see page 86). In the prophylaxis therefore of bronchitis, vitamin considerations must not be left out of account, and vitamin A in particular must be supplied in adequate amount, either in some natural form such as cream, butter, or cod-liver oil, or as a concentrate in the form of carotene or Avoleum (B. D. H., Ltd.).

From the point of view of infection there is to my mind considerable danger in the somewhat widespread practice of feeding infants on half-cream dried milks, or other forms of milk from which part of the fat has been removed.

There are however many other environmental factors besides those of nutrition which must be taken into consideration in the prevention of bronchitis. For instance, want of sunshine, and the presence of suspended dirt in the smoky atmosphere of our large industrial centres explains why bronchitis and other respiratory diseases are more common in manufacturing towns than in the pure air of the country. Again, cold damp climates, insufficient clothing, wet feet, and want of physical exercise, are also etiological factors which must not be forgotten.

Hypersensibility of the respiratory mucous membrane to the influences of cold air can certainly be acquired by living in houses or rooms centrally heated and kept at unduly high temperatures, but the discrete application of hardening methods—that is to say the training of the heat-regulating mechanisms by the use of the graduated cold bath, or spraying with douches of cold water, as well as by the hygienic heating and ventilation of both living and sleeping rooms, are important elements in the prophylaxis of bronchitis.

Curative.

Since any ordinary cold, whether neglected or not, may extend downwards into the trachea, and reach the bronchial tubes, it is always wise to recognize this possibility and treat every ordinary case of coryza, however slight, as a potential case of bronchitis, and requisition all possible means capable of aborting an attack in its early stages. In the section on the "Common Cold" (see page 229) certain preliminary measures of a semi-prophylactic nature are described in order to cut short an attack, and to these the reader is referred, but when once the definite symptoms of

bronchitis have begun to develop the following steps should be taken to deal with the spreading catarrh of the bronchial tubes on a rational basis, and in conformity with its successive pathological stages.

The inflammatory process once started must continue in unbroken sequence and without interruption right up to the end. These stages cannot be short-circuited, but they may be expedited by appropriate means, so that the transition from the first to the second, and from the second to the third, takes place rapidly, and the total length of the attack is reduced to the shortest possible period. The general management of the case is at least as important as the drug treatment, and includes considerations of feeding, nursing, and temperature.

Feeding. Feeding in the case of a breast- or bottle-fed baby needs no change, either as regards quantity or quality of the food, but if owing to weakness or respiratory distress the infant is unable to suck sufficiently strongly to obtain its due allowance, spoon feeding should be resorted to.

In the case of older children already on a mixed or solid dietary, the food should be mainly, but not necessarily exclusively, of a fluid character. It should be limited as regards caloric value and consist mainly of such invalid foods as soups, broths, jellies, and an almost unlimited amount of orange-juice or grapes. I am not at all in favour of the popular " Milk Diet " for invalids of any kind, not excluding those suffering from bronchitis. Cow's milk is by no means an easily digested food—it is a solid food in the stomach, if it is fluid before it is swallowed, moreover, it contains far too large a proportion of protein for invalid requirements. Its chief virtue lies in the fact that it contains all the vitamins and other accessory factors required for any complete dietary. But with our modern knowledge and resources these can be provided in far better forms than in milk. All the same, I believe it to be useful to provide a sick infant 1 year of age with from 10 to 20 oz. of milk in the 24 hours, which should be pre-digested; for preference, in the form of Benger's Food (prepared as directed on page 709).

There is no reason, as far as I know, why in an acute illness such as bronchitis, a sick infant should not be allowed a certain amount of such solid food as simple biscuits, sponge fingers, or sponge cakes, if the child evinces any inclinations to take them, for if they are solid before they are eaten, they become a sop in the stomach, and are just as easily digested as the bread and milk which is considered so universally suitable for the sick.

I do not advise the " little and often " methods of feeding,

except in the case of children who are so ill that they cannot take a reasonable amount of any one feeding. The food may be given every 4 hours during the day and night if the child is awake, but the latter should not be roused from sleep to take it. Such intervals give the stomach opportunities for emptying and recovering before the next feed. The caloric requirements of a healthy child, immobilized and kept warm in bed, are less than those of a child taking active physical exercise, and the requirements of a sick child are still less. For this reason the caloric allowance should be cut down considerably, perhaps by as much as 40 per cent of the normal, and the child should not be forced to take more food than it desires. I believe nothing more retards recovery than over-feeding.

Nursing. The question of room temperature, ventilation, steam tents and bronchitis kettles, always arises in the nursing of these cases, and there are diverse views with respect to each. It may be said that cold, foggy, or smoke-laden air is extremely harmful to the bronchitic subject, but it does not follow from this that hot or moisture-laden air is always beneficial. In the early stages of bronchitis with tightness of the chest and scanty expectoration, a tent and a bronchitis kettle may give great relief, but they are not required in the later stages.

The temperature of the room throughout the attack should be maintained between 62° and 65°. The room should be well ventilated, but actual draughts excluded from reaching the patient. Some of the irritating and suspended matter in foggy air can be removed by arranging a wet sheet or screen so as to intercept and filter the air which enters from the outside.

Drug Treatment.

Local. Poulticing and counter-irritation of the chest by stimulating liniments, such as Compound Camphorated liniment, are useful but sometimes disturbing. A lint jacket smeared with a cataplasm of kaolin or Antiphlogistine is probably preferable, although it makes it difficult for the doctor to make a physical examination. This may not however be an unmixed evil.

Internal. As described under tracheitis (see page 253). The inflammatory process of a catarrh of the bronchial tubes passes through several stages, each of which requires its own appropriate treatment. The routine administration of a stock bronchitis mixture containing ipecacuanha and carbonate of ammonium during all stages of the inflammation is to be deprecated on scientific and clinical grounds.

1*st Stage :* With congestion and scanty secretion : lasting from 1–2 days, this stage requires a sedative expectorant which en-

courages secretion. It may conveniently consist of the following :

Mistura Tussis No. 1

Citrate of Potassium	5 gr. (0·3 gm.)
Iodide of Ammonium	1 gr. (0·06 gm.)
Wine of Ipecacuanha	5 minims (0·3 c.c.)
Camphorated Tincture of Opium	3 minims (0·2 c.c.)
Syrup of Orange	10 minims (0·6 gm.)

Peppermint water to make 1 fluid drachm (3·5 c.c.)

One drachm every 4 *hours.*
For an infant 1 *year of age.*

2*nd Stage :* With free mucus secretion, lasting 5–6 days, the second stage requires a stimulant expectorant as follows :

Mistura Tussis No. 2

Carbonate of Ammonium	1 gr. (0·06 gm.)
Wine of Ipecacuanha	5 minims (0·3 c.c.)
Tincture of Squills	3 minims (0·2 c.c.)
Camphorated Tincture of Opium	3 minims (0·2 c.c.)

Peppermint water to make 1 fluid drachm (3·5 c.c.)

One drachm every 4 *hours.*
For an infant 1 *year of age.*

3*rd Stage :* With muco-purulent secretion, the third stage requires the antiseptic, styptic, healing and expectorant properties of the Balsams :

Mistura Tussis No. 3

Carbonate of Ammonium	1 gr. (0·06 gm.)
Compound Tincture of Benzoin	5 minims (0·3 c.c.)
Syrup of Tolu	10 minims (0·6 gm.)
Gum of Acacia	1 gr. (0·06 gm.)

Peppermint water to make 1 fluid drachm (3·5 c.c.)

One drachm every 4 *hours.*
For an infant 1 *year of age.*

It can scarcely be doubted that some close, though possibly indirect association exists between the state of the mucous membrane of the alimentary tract and that of the respiratory system. Many years ago, before it was recognized that the value of liquid petroleum in the treatment of constipation [1] and other bowel conditions must depend entirely upon its mechanical action, Angier's Petroleum Emulsion was not only sold and recommended as a substitute for cod-liver oil, and as a useful preparation in bronchitis and other affections of the respiratory

[1] *The Practitioner*, Vol. lxxxiv, No. 5, p. 583, 1910 ; *Clinical Journal*, July, 1914 ; *The American Practitioner*, July, 1914.

system, but these statements were accepted and believed in by a very large number of practitioners. If this belief in the efficacy of petroleum has any justification at all, which I think it has, it must depend primarily on its mechanical effects on the functions of the bowel, and only secondarily on catarrhal conditions of the respiratory tract. But this widespread faith in the therapeutic value of petroleum in the treatment of respiratory diseases only strengthens my own belief that the correction of unhealthy conditions of the bowel, such as an intestinal toxæmia, or a chronic colitis, is an important element in the prophylaxis and cure of bronchitis.

Bronchiectasis

(Pulmonary Fibrosis)

Nearly all cases of bronchiectasis develop as a result of an unresolved pneumonia, generally of the broncho-pneumonic type, occasionally as a terminal complication of measles, whooping-cough, or influenza. The exact pathology of the condition, though of great interest, need not be considered here, further than to remark that it consists of a general fibrosis of lung tissue with excavation, and dilatation and thickening of the bronchial tubes.

The main characteristics of this condition, although it may pass through successive stages, are its chronicity, constant cough, and the expectoration of large quantities of sputum, usually offensive. In the severer type of case with large suppurating cavities, there are constitutional symptoms due to septic absorption.

The exact distribution of the bronchiectatic changes and the degree of fibrosis can be established by X-ray examination, with or without previous introduction of Lipiodol into the trachea, by means of which the involved areas of the lung can be mapped out with the greatest precision (see page 726).

Treatment. *Prophylactic.* The prophylactic treatment is mainly concerned with preventing the passage of an acute broncho-pneumonia into a chronic condition, that is to say, by expediting the resolution of the consolidated lung. I am quite convinced that the free exhibition of iodide of potassium promotes this end, and I have given as much as 3 grains three times daily to an infant 1 year old for this purpose.

If children under 5 years of age can be saved from attacks of measles, whooping-cough, or influenza, three of the most prolific sources of bronchiectasis will be eliminated. A great deal can be done nowadays by the intelligent use of convalescent serum (see

pages 392, 419 and 409) to avoid such attacks, or at least to mitigate their severity, and although this method is often difficult to employ, owing to the scarcity of serum, it is well worth trying (when the serum can be obtained) in all cases in which young children are known to have been exposed to sources of infection. In the case of both whooping-cough and influenza, prophylaxis by the use of vaccines is worth trying, so long as the latter are applied before the beginning of the incubation period; after actual infection has taken place they are in my experience useless.

Curative. The early treatment of bronchiectasis is in the main the same as the late treatment of broncho-pneumonia—that is to say, every possible precaution must be taken to prevent the acute condition developing into one of fibrosis and excavation. If complete resolution has not taken place within 6 months, one may reasonably assume that some degree of fibrosis has already occurred, and that there is no probability of a return to the *status quo.* Excavation and thickening of the bronchial wall with dilatation is a slow process, and its degree may be roughly gauged by the severity of the cough, and the amount of the expectoration, although the latter is sometimes difficult to estimate in a young child who swallows the sputum.

The treatment of bronchiectasis when once it is fully established must be directed to the following points:

1. The maintenance of the general health and resisting power by provision of the best possible hygienic conditions, including good feeding, open-air treatment, deep breathing, and other special exercises for expanding the collapsed lung.

2. The treatment of any coexisting sinusitis, rhinitis, adenoids, enlarged tonsils, carious teeth, or oral sepsis, in order to prevent reinfection.

3. Effective expectoration of accumulated sputum by inversion or other postural means, or, in the case of very young children, by the occasional administration of an emetic such as:

Wine of Ipecacuanha	1 drachm (3·5 c.c.)
Carbonate of Ammonium . . .	6 gr. (0·36 gm.)
in	
Half an ounce of warm water	(15 c.c.)

4. Antiseptic measures to prevent absorption of septic matter accumulated in suppurating cavities.

5. Surgical measures to promote drainage or obliteration of cavities.

Drug Treatment. In my experience the most efficient antiseptic treatment for bronchiectatic cavities of the lung is the free admin-

istration of creosote by the mouth. The dosage should be pushed until the smell of creosote can be detected in the breath, or in exudations from the skin. So effective are the antiseptic results of this method that not only does the sputum lose its offensive odour, but the fæces themselves may become practically odourless. As much as 1 drachm (3·5 c.c.) daily may be given in divided doses to a child 2 or 3 years of age. There is a popular belief that creosote in large doses invariably upsets the digestive process and produces carboluria, or a smokiness of the urine. If it does so, it is time to reduce the dosage, but I have had a long experience of these massive doses and they very rarely produce such effects, while the advantages of the treatment are so enormous that the possibility of any of the above accidents should not be regarded as contra-indications to its application.

Should we come to the end of our resources in the medical treatment of this condition, we have happily at the present time a final appeal to surgery. Many successes have been recorded at the Brompton Hospital in the artificial drainage of bronchiectatic cavities, while thoracic surgeons have had equally good results in inducing their collapse by induction of pneumo-, or oleo-thorax.

Asthma

An acute attack of asthma is due to the spasmodic contraction of the unstriated musculature of the small bronchi or bronchioles. This not only interferes with the to-and-fro movement of air, but renders respiration both laboured and noisy. It is also usually accompanied by turgescence and hyper-secretion of the mucous membrane. But one attack of asthma does not make an asthmatic. What really constitutes the disease asthma is the frequent recurrence of these attacks in susceptible subjects on very slight provocation. Other characteristics are the suddenness of the onset, its rapid cessation, and the usual absence, at least in older subjects, of a definite bronchitis. Asthma is in fact a sort of habit in which the unstriated musculature of the bronchial walls passes into an exaggerated condition of tonus under the influence of insignificant stimulation. Under normal conditions this tonus is subject to never-ceasing variations in the antagonistic stimulation of the sympathetic and vagus nerves. Tonus is raised by vagus and decreased by sympathetic stimulation. It would appear therefore that in asthma there is some disturbance of balance between these two sets of antagonistic nerve impulses, which results in a preponderance of the vagus effect.

There are strong analogies between attacks of asthma and of pyloric spasm. The nerve centres which control the tonus of

the bronchial musculature may not be so strictly circumscribed or segregated as many others, such for instance as those concerned in respiration, but all the same, the nerve cells, whether sympathetic or vagal, working as a single unit, seem to acquire in asthma a very high degree of sensitiveness which renders them susceptible to sub-minimal degrees of stimulation.

The eliciting agents may take the form of reflex chemical or psychic stimuli. Among the reflex sources of stimulation must be included those associated with nasal polypi, enlarged or congested turbinates, sinusitis, enlarged tonsils, carious teeth, a hypersensitive nasal septum, indigestion, constipation, or worms.

Chemical stimuli are numerous and operative in such infinitesimal amounts that it is often difficult to explain their *modus operandi*. It may be questionable whether they act directly on some highly sensitive area of mucous membrane, as that of the nasal septum for instance, and thus indirectly give rise to the asthmatic reflex, or whether after absorption into the blood these allergic re-agents directly stimulate the nerve cells which control the tonus of the bronchial musculature. But in whatever way the phenomenon is interpreted it is difficult to explain how such imponderable forms of stimuli as the emanations of cats, horses, rabbits, flowers, grasses, or feathers, can produce such violent allergic reactions. The effects of bacterial substances, and the proteins of certain foods such as eggs, milk, cereals, etc., are perhaps more explicable.

Psychic forms of stimulation are of the most varied character, and include emotional disturbances, sights, sounds, odours, and other events, which through an association of ideas recall unconscious memories of some past attack. The fact that such psychic stimuli can only act through the medium of the nerve cell strengthens the likelihood that in all cases of asthma the paroxysm is aroused through the agency of some highly sensitive reflex mechanism. Whether this is so or not, it seems to me that such an interpretation greatly assists in the rational treatment of the condition, both in the curative and in the prophylactic sense, and for this reason I have entered somewhat fully into the etiological aspects of asthma.

Asthma in infants and young children takes a somewhat different form from that which it takes in adults, in that it almost invariably has an element of bronchitis, no doubt from anatomical reasons mainly dependent on the small calibre of the bronchial tubes. This means that an attack of asthma in the case of young children takes longer to clear up, and thus loses one of the most characteristic features of the adult type. Infants who " cut their

teeth " with attacks of bronchitis are really candidates for asthma, though the true " habit " may never eventuate. I have had many opportunities of watching these recurrent attacks of so-called bronchitis in infants developing in later years into a true asthma, just as I have seen many cases which have completely grown out of the habit when all the teeth have been cut. Whether or no these recurrent attacks of bronchitis develop into a regular asthmatic habit depends on various factors, one of them being the extent to which allergy plays a part in the etiology.

Treatment. *Prophylactic.* The chief essential in the prevention of asthma is a careful study of the etiology, and observance of the lessons thereby taught. The asthmatic habit is very easily acquired and therefore one of the most important elements in the prophylaxis must be the prevention of a recurrence of the attacks, from teething or other cause, at a time when habits are most easily established—that is to say, in infancy and early childhood. If the exciting stimulus, whether chemical, reflex, or psychic, can be discovered, the solution of the problem may be simplified, but it is very seldom that the etiology of any particular case of asthma in early childhood is so simple as to depend upon any one single factor.

In susceptible subjects, which for want of a better term we may call " allergic," the fundamental source of the trouble appears to be some undue sensitiveness of the whole of the central nervous system to all and every form of stimulation, and the main hope of successful prevention lies in the skilful treatment of the nervousness itself. This does not mean that all and every source of reflex irritation which provokes bronchial paroxysms must not be sought out and treated, but it does mean that the main treatment must be directed towards the stabilization of the nervous system itself. The general excitability of the central nervous system depends very considerably on the character of the reflex irritation to which it is habitually exposed, on the degree of fatigue induced, and on the opportunities for rest and recovery.

The degree of excitability of the central nervous system can be raised or lowered by excitant or depressant substances circulating in the blood-stream. For instance, excess of thyroid secretion or of the products of intestinal toxæmia circulating in the blood will certainly unduly raise the level of excitability, and the administration of strychnine will certainly have the same effect, whereas depressant drugs such as the bromides or the iodides, or purgation will have the opposite effect, and lead to depression. The prophylactic treatment therefore of asthma includes the avoidance of all forms of adverse reflex stimulation, and protec-

tion of the central nervous system from fatigue and from poisons of all kinds, whether autogenous or external, which can interfere with its stability.

The dietetic régime is obviously important from the point of view of the avoidance of all forms of indigestion, especially achlorhydria, constipation, intestinal toxæmia, mineral depletion, status calciprivus, acidosis, and any of the avitaminoses.

Atmospheric and climatic conditions are also of importance. Moderately dry, cool and clean air as well as high altitudes (over 4,000 ft.) are favourable factors. Low altitudes, smoke, or otherwise unclean and damp air are unfavourable.

The prophylaxis of asthma is fundamentally bound up with that of the "Common Cold," since any catarrhal condition of the bronchial tubes is invariably accompanied by some degree of spasm. On these grounds no measure calculated to prevent this kind of infection should be omitted.

Curative. The cure of the asthma habit consists essentially in the prevention of the individual attack, and for this reason the above paragraphs should be carefully studied. The treatment of the individual attack is another matter however, and fortunately under present conditions generally successful. The treatment of the general condition of asthma consists in the following:

1. Removal of all existing causes, such as sinusitis, enlarged tonsils, adenoids, carious teeth, or polypi, which can elicit the asthma reflex, or cauterization of the asthmogenic zone of the nasal septum.

2. Treatment of indigestion, achlorhydria, intestinal toxæmia, exclusion from diet of such articles as eggs, cereals, fats, etc., which are known to excite attacks, and avoidance of late meals and over-feeding.

3. The choice of suitable climatic conditions, high altitudes, pure air, etc.

Specific Treatment. General desensitization by intra-muscular injections of peptone, tuberculin, and milk. Specific desensitization by hypodermic injections of allergens which are known to excite attacks.

Treatment of the Attack. It must be remembered that in the case of babies and young children the asthmatic attack is nearly always complicated by some degree of bronchitis which must receive its own appropriate treatment, for details of which see page 257.

As regards the specific treatment of the asthmatic attack, it may be stated that the old lines of treatment with lobelia, stramonium, chloric ether, saltpetre, the burning of Hemrod's powder,

the spraying of cocaine, or the giving of morphia by hypodermic injection, have been quite superseded by the modern treatment with adrenalin. This has an important and a specific action, though of a temporary nature. At the beginning of an attack, 2–3 minims (0·13–0·2 gm.) of adrenalin solution (1 in 1000) should be injected hypodermically, and repeated if necessary. This should be followed up by 1/8th (0·008 gm.) to 1/4th (0·015 gm.) of a grain of ephedrin, given by mouth, or better by 10–15 minims (0·6–0·9 c.c.) of Ephedrin Compound (P. D. & Co.) at eight-hourly intervals.

Broncho-pneumonia

(Catarrhal Pneumonia, Lobular Pneumonia, Capillary Bronchitis)

In young infants the clinical distinctions between broncho-pneumonia, catarrhal bronchitis, and capillary bronchitis, are rather those of degree than of kind, owing to the absence of any definite line of demarcation between the limits of the bronchial tubes and the pulmonary alveoli. But as the child gets older the distinction becomes more pronounced, and the diagnosis between a simple bronchitis on the one hand, and a true broncho-pneumonia on the other, come more within the range of practical politics. All the same we now hear less and less about capillary bronchitis as a definite disease entity, and are beginning to regard it either as a severe form of catarrh of the small tubes, or as a mild broncho-pneumonia.

Broncho-pneumonia can occur as a primary disease, as the result of a general pneumococcal or catarrhal infection, but more frequently as a terminal event in some chronic or debilitating illness, such as a gastro-enteritis, or infantile atrophy. It also frequently occurs as a complication of measles, whooping-cough, sepsis, or summer diarrhœa.

Personally I do not regard rickets proper as an important predisposing cause of broncho-pneumonia, although it is generally so described. However, it naturally affects the prognosis and the mortality adversely. What is commonly called rickets is a combination of perhaps many different deficiency symptoms due to various defaulting factors in the dietary. Some of these, and especially vitamins A and C, influence the susceptibility of the infant to any kind of infection, not excluding that of broncho-pneumonia, but I do not believe that a pure case of rickets, that is to say, a deficiency disease due to deprivation of vitamin D, and possibly calcium salts, plays any important part in the etiology of broncho-pneumonia.

Bacteriological examinations show that the prevalent organisms

in broncho-pneumonia are the pneumococcus, Pfeiffer's bacillus, Friedländers bacillus, hæmolytic streptococci, and staphylococci, whilst in the new-born the bacillus coli is sometimes found almost in pure culture, and in whooping-cough, Bordet's bacillus. As a rule, however, the flora is a mixed one. Since the rational treatment of broncho-pneumonia, which is definitely an infection, will almost certainly in the near future, depend on the application of specific serological remedies, the importance of a correct identification of the infective organism need not be insisted on here.

Treatment. *Prophylactic.* The prophylaxis of broncho-pneumonia covers the whole gamut of the laws of infant hygiene, and naturally includes considerations of immunity and susceptibility. As has been indicated in the section on prophylaxis against bronchitis (see page 256), avoidance of exposure to infection must play an important part. Good ventilation, good housing, pure air, out-of-door life, and avoidance of contact with infected persons or carriers, must be included among the number of prophylactic measures.

Actual resistance to infection depends on :

1. The state of nutrition of the child, that is to say, largely on correct feeding, especially as regards the accessory factors.
2. On the healthy state of the alimentary tract.
3. On the efficiency of the heat regulating centres, in order to avoid the evils of chill.
4. On the efficiency of the circulation, by suitable clothing, and exercise ; also in order to avoid chills.
5. On the degree of immunity to specific infections, which even now with our present resources can be enhanced by protective inoculation, and other methods of immunization, and which doubtless in the near future will come more and more within the range of practical politics.

Curative. The general treatment of these cases should be carried out on very much the same lines as those advised for acute bronchitis (see page 257), with special adaptations and modifications in conformity with the etiological nature of the attack, that is to say, according as to whether it is a complication of measles, whooping-cough, influenza, or sepsis, or other acute infection, a terminal event in the course of some wasting disease such as a chronic enteritis, or infantile atrophy. The chief points to which attention should be directed are as follows :

1. Heart failure, owing to a general toxæmia, or embarrassment of the pulmonary circulation, with dilatation of the right heart.
2. Cyanosis or anoxæmia, owing to consolidation or collapse of lung, or occlusion of the alveoli with mucous secretions.

3. Ineffectual expectoration of sputum, owing to age or general feebleness of the child.

4. Failure in resolution of consolidated lung, with repeated collapse and final development of a chronic fibrotic condition of the lung, with or without bronchiectasis.

Feeding. As in acute bronchitis (see page 257). Over-feeding should be avoided. Beef-tea, broths, jellies, barley-water, orange-juice, grapes, Benger's Food (see page 709), sponge cakes, and rusks, may be given at four-hourly intervals.

Nursing. The temperature of the room should be between 62° F. and 65° F., well ventilated, with open-air treatment in summer. The mattress should not be too soft, nor the clothing too heavy. With cyanosis, oxygen inhalations may be given, or a tent used. With congestion of bases of lung and dilated right heart, inter-scapular cupping or leeching should be applied. Withdrawal of blood from accessible vein by means of a syringe relieves the right heart.

Mouth, fauces, and nasal cavities to be kept clean, and free from secretion by syringing or spraying with Milton, Glycothymoline or Thymoline Lotion (see page 704).

The chest may be encased in light gamgee jacket or lint spread with Antiphlogistine, or cataplasm of kaolin : later rubbing with stimulating liniment, such as compound liniment of camphor.

Internal Treatment.

For Irritating Cough

Compound Syrup of Cocillana (P. D. & Co.) 10 minims (0·6 c.c.).
or Compound Tincture of Opium 3 minims (0·2 c.c.).

For Expectoration (if scanty)

Mistura Tussis No. 1 (page 688).

For Expectoration (if excessive)

Mistura Tussis No. 3 (page 688) with added
Tincture of Belladonna 3 minims (0·2 c.c.).

For Expectoration (if ineffectual)

with choking of lung, and child not too collapsed.

Give emetic consisting of Wine of Ipecacuanha 1 dr. (3·5 c.c.).
Carbonate of Ammonium 6 gr. (0·36 gm.) in ½ oz. warm water (15 c.c.).

Heart Failure

10 drops (0·6 c.c.) of Brandy at intervals.
or 2 minims (0·13 c.c.) Coramine
¼ gr. (0·015 gm.) Camphor in Olive Oil
or 3 minims (0·2 gm.) Adrenalin solution (1 in 1000) all three hypodermically.

Sleeplessness and Restlessness

Often troublesome symptoms but not advisable to give highly depressing drugs—

5 gr. (0·3 gm.) Bromide of Ammonium
or ¼ tablet of Somnosal, may be given safely.

Special Serological Therapeusis. This is not so reliable as in the case of croupous or lobar pneumonia. The sputum seldom contains types 1 or 2 of the pneumococci, and therefore anti-pneumococcal serum is not indicated. The infection is usually a mixed one, containing hæmolytic streptococci, bacillus catarrhalis, or influenzæ. Under such conditions a polyvalent streptococcal serum may be of service. Give 3 c.c. of Parke Davis & Co.'s refined and concentrated polyvalent streptococcic serum. To be repeated in slightly larger dosage in 3 days' time, if the result of first injection is satisfactory.

Lobar-pneumonia

(Croupous Pneumonia, Alveolar Pneumonia)

The distinctions between lobar- and broncho-pneumonia are at all ages somewhat indefinite, but particularly so during the 1st year of life. A pure pneumococcal infection, however, whether of the lungs or other part of the body, often seems to present a somewhat characteristic clinical picture, unlike that of broncho-pneumonia, which is helpful in the differential diagnosis between the two diseases.

With a pneumococcal infection, the rapidity of breathing, high temperature, frequent pulse-rate, flushed face, and the working of the alæ nasi, constitute a combination of symptoms which are almost pathognomonic. In contradistinction to broncho-pneumonia the physical signs in the chest in lobar-pneumonia, anyhow, at the beginning of an attack are insignificant, in fact they may consist in very little more than slight dullness, and an impaired entry of air over the affected part of the lung. Whereas in broncho-pneumonia there are in addition catarrhal symptoms, with râles and rhonchi over large areas of the lungs, excessive coughing, and copious expectoration. The rusty sputum which is so diagnostic of pneumonia in adults, is very often absent in the case of infants and young children, partly because the expectoration is swallowed, and partly because complete consolidation prevents the feeble efforts of a child from coughing up the thick tenacious sputum.

The pathology, or more strictly speaking, the pathogenesis of croupous pneumonia is not to be explained on the simple grounds that it is a pure pneumococcal infection, with a selective affinity

for some particular lobe or area of the lung. Firstly, because the pneumococcus is commonly present in the mucous membrane of the throat and lungs of healthy individuals, as also in cases of broncho-pneumonia, and also because it is occasionally absent in definite cases of croupous pneumonia, in which it is replaced by the streptococcus viridans, bacillus influenzæ, micrococcus catarrhalis, staphylococcus aureus, pneumobacillus, or the streptococcus hæmolyticus.

Although there are several types or groups of pneumococci with varying bacteriological characteristics, and with varying degrees of virulence, the actual type of the organism is not a determining factor of the character which the disease assumes, for all varieties can produce a typical croupous pneumonia, though perhaps the mortality rates which accompany them may be very different. Chill, exposure, exhaustion and debility, are all factors to be reckoned with as affecting the susceptibility of the child, and the gravity of the attack although, as is well known, perfectly healthy children can fall victims to the disease, and take the disease very badly.

The question of the degrees of virulence displayed by the different types or groups of pneumococci is attracting a good deal of attention at the present time, both from the point of view of prognosis and of treatment. It seems to be generally agreed that the virulence of type 3, is the greatest, with correspondingly high mortality, while that of type 4 is lowest, with types 1 and 2 taking intermediary positions. The significance of this is important because so far the treatment of these different types or groups by specific serological methods has been confined to types 1 and 2, to the exclusion of type 3, which is most in need of treatment.

Treatment. *Prophylactic.* As regards prevention very little that is useful can be said on this subject. The avoidance of exposure to chill, exhaustion and infection, are obvious factors in the prophylaxis, but it is common experience that a genuine croupous pneumonia is very seldom fatal, even in the case of quite young babies, and in spite of its very alarming manifestations, so long as the patient is in a good condition of nutrition at the time of the attack. Infants and children suffering from the various forms of deficiency diseases make poor subjects for an attack of pneumonia, and this is particularly true in respect of deficiencies of vitamins A, B, and C, but in my experience to a lesser degree in respect of vitamin D, so that from the point of view of prophylaxis, attention to the vitamin requirements needs no emphasis here.

Curative. It must be remembered that an ordinary case of croupous pneumonia is a self-limited disease, with a very low mortality even in the case of young babies, so that any elaborate or drastic procedures in the way of treatment are clearly unnecessary. Another point which must not be disregarded is that there is nothing so valuable in the management of the case as fresh air, even open-air treatment.

With a broncho-pneumonia the case is more difficult. Cold air may prove too irritating to the sensitive and catarrhal mucous membrane of the respiratory system, and for this reason, if for no other, it is important to make sure of an accurate diagnosis before adopting an open-air line of treatment.

Food. As in most other cases of acute illness of young children, so in the case of croupous pneumonia, over-feeding is a great mistake. Easily digested or perhaps pre-digested protein food is required to keep up the elaboration of specific antibodies, the manufacture of which is the function of protein metabolism, but large quantities of milk are contra-indicated. About 1 pint of milk, best perhaps in the form of Benger's Food (see page 709), will provide enough protein for this purpose. Other varieties of food should consist of beef-tea, broths, jellies, orange-juice, grapes, and a small quantity of sponge cake or sponge fingers, if the child shows any inclination for dry food.

Nursing. As has already been suggested, one of the most important conditions of the successful treatment of croupous pneumonia is that the patient should be kept in the open air as far as atmospheric conditions allow. At The Infants Hospital it was usual for cases of croupous pneumonia to remain out of doors on the balcony during the whole of the day, and sometimes even part of the night, unless there was some definite contra-indication, and the results left little to be desired. Fresh moving air exercises a highly stimulating influence on metabolism. For this reason, infants and young children suffering from pneumonia should not be submerged in deep ill-ventilated cots as is so often the case in order that they may be protected from the slightest draught.

Oxygen. In the majority of cases the best way to provide oxygen is in the form of fresh air—plenty of it, and not too warm. So long as the child maintains a good colour, there is no need for the oxygen cylinder, but cyanosis and laboured breathing are definite indications for the special provision of oxygen in concentrated form. It is best supplied through the medium of a thin catheter inserted for about 2 inches into the nostril, with its eyehole directed downwards and its proximal end attached to

the indiarubber supply tube of the oxygen cylinder. The oxygen should be allowed to bubble through a Wolf's bottle containing warm water with a small quantity of brandy. The amount of oxygen required is not great, but it should be allowed to escape from the cylinder at a rate of about 30 bubbles a minute.

Drugs. There is no specific drug treatment for croupous pneumonia, but special symptoms or emergencies require their own individual management.

1. PAIN: May be relieved by poultices, Antiphlogistine, or Cataplasma Kaolin.

2. COUGH: May be relieved by Elixir Heroin: 10 drops (0·6 c.c.) occasionally.

3. PYREXIA: Requires no treatment unless it is as high as 105°, when sponging with tepid water is better than the use of anti-pyretics.

4. DELAYED RESOLUTION may be assisted by iodine treatment: 3 gr. (0·2 gm.) iodide of potassium should be given four-hourly.

5. HEART FAILURE: Should be treated by brandy: 10–20 drops (0·6–1·2 gm.) three-hourly. Strychnine 1/200 of a grain (0·0003 gm.) hypodermically, coramine 3 minims (0·2 c.c.), or camphor $\frac{1}{4}$ gr. (0·015 gm.) in olive oil given hypodermically. Leeches, cupping, or extraction of blood by a syringe inserted into the Median Basillic or other accessible vein.

Specific Serological Treatment is unnecessary in mild cases and generally useless in severe ones, but if from bacteriological examination of sputum a practically pure culture of pneumococcus of Type 1, or Type 2, or of the hæmolytic streptococcus can be isolated, specific serum treatment is indicated, but the serum must be given early in the disease. In the case of pneumococcus 1 or 2, inject intravenously if possible, otherwise intra-muscularly, 5,000 units of Felton's Anti-pneumococcus serum and repeat twelve-hourly for 3 days, in increasing doses.

In the case of hæmolytic infection, inject St. Mary's Hospital Polyvalent Anti-Streptococcic serum to the extent of 3 c.c. either intravenously or intra-muscularly, and repeat at twelve-hourly intervals for 3 days, gradually increasing the dose to 5 c.c.

Pulmonary Tuberculosis

Tuberculosis of the lungs in infants and young children may take a variety of forms, of which the following are the more common:

1. Involvement of the bronchial or hilus glands, with extension into the substance of the lungs—so-called hilus disease.

2. Acute tuberculous pneumonia.
3. Chronic pulmonary tuberculosis, sometimes called phthisis.
4. Acute miliary tuberculosis.
5. Epi-tuberculosis.

A differential diagnosis between any of the above definitely tuberculous conditions, and other forms of pulmonary infection is at times extremely difficult, but it is simplified by evidence on one or other of the following points :

1. A history of exposure to human infection, or the consumption of raw and suspected cow's milk.
2. The presence of constitutional symptoms, such as evening temperature, loss of morning appetite, loss of weight, and fatigue on slight exertion.
3. A positive Mantoux test.
4. The presence of tubercle bacilli in the sputum, stomach washings, fæces, or urine.
5. X-ray evidence, especially in oblique views of chest.

Although a positive Mantoux test proves previous sensitization by the living tubercle bacillus, it is not proof of an existing and active tuberculous condition. Personally, I place far greater reliance on the localized reaction which follows a hypodermic injection of Koch's Old Tuberculin. If in a child suffering from pulmonary tuberculosis a small dose of Koch's Old Tuberculin (1/4,000 mgm.) is injected hypodermically, there will be almost certainly a focal reaction at the site of the lesion, not at the site of the injection, a reaction which in addition to an exaggeration of any pre-existing physical signs, is accompanied by an exacerbation of cough, a rise in temperature, and acceleration of the pulse. A well-marked reaction of this kind is pathognomonic of pulmonary tuberculosis.

Treatment. *Prophylactic.* Probably the most important prophylactic measure of all is the removal of the child from the tuberculous environment, if such is known to exist. The boiling of all milk in the case of artificially fed infants is also an essential factor. After measles, whooping-cough, chicken pox or any other of the exanthematous fevers, especially if they follow one another in rapid succession, special precautions and prolonged periods of convalescent treatment are indicated.

Specific inoculation with cultures of the tubercle bacillus by the so-called Calmet-le-Guerin (B. C. G.) method has been somewhat extensively employed on the Continent, but owing to a series of accidents connected with the inoculations, the method has for a time been under a cloud. This to my mind is to be regretted, as there are distinct possibilities in its application.

On the other hand a course of inoculations of Koch's Old Tuberculin (see page 157), is entirely free from danger, and has, in my hands, proved extraordinarily successful.

Apart from such specific lines of treatment, prophylaxis entails the maintenance of nutrition by a well-balanced dietary, with special attention to high protein feeding. A one-sided carbohydrate or vegetarian dietary is distinctly unfavourable from the point of view of prophylaxis.

Heliotherapy, and open-air treatment are just as important in connection with prophylaxis as they are with cure.

Curative. I am convinced that the cure of pulmonary tuberculosis in all its varieties is possible in the early stages, and at all ages, even in very young babies, but as a rule before the condition is diagnosed it has reached a stage at which recovery is impossible. Many infants suffer from unsuspected tuberculous infections from which they recover, and very possibly become highly immune, but for such a happy consummation it is essential that the dose of the tuberculous infection should not be too massive, or too virulent, and that the infants themselves should be strong and of good resisting power.

Acute attacks of tuberculosis are very difficult to diagnose in young children, and especially in infants. It is quite astonishing to find how far an acute tuberculosis can proceed without attracting attention. Post-mortem examinations give abundant proof of the truth of this statement. This is to my mind the explanation of the common belief that pulmonary tuberculosis is always fatal in infants under 1 year of age, and generally fatal in children between 1 and 3 years of age. I would rather put it this way: tuberculosis in infants and young children is always fatal when it reaches the stage when it can be diagnosed by the ordinary means of physical examination, but if it can be detected in the really early stages by the hypodermic injection of tuberculin, or by other means, it is in most cases curable. This is why the early diagnosis of tuberculosis in infants and young children is so important, and why every means at our disposal for treating it should be applied at the earliest possible moment. Although I am personally opposed to the tuberculin treatment of advanced cases of tuberculosis in children, I am equally strongly in favour of it during the early stages, *i.e.* before the disease is sufficiently advanced to be capable of diagnosis by ordinary physical examination. If the degree of damage is so slight that it requires an injection of Koch's Old Tuberculin to elicit the physical signs by which it can be diagnosed, these are the cases which respond so successfully to the specific tuberculin treatment.

The real difficulty however in the treatment is to make the diagnosis at a sufficiently early stage. (The details of this treatment are described on page 157.) This specific treatment must be supplemented however with open-air treatment, heliotherapy, vitamin therapy, dietetic treatment, and high protein feeding, just as it is required in the prophylactic treatment.

Breast feeding, especially when the mother is the primary source of the infection, is one of the most important factors for success, since the milk of a tuberculous mother will certainly contain small, if not large, quantities of specific protective bodies. (The question of the eligibility of the tuberculous mother to nurse her infant is considered on page 20.)

Drug Treatment. Most authorities belittle the value of drug treatment in cases of pulmonary tuberculosis in infants and young children. Personally, this is not my view. I have had cases too far advanced for specific treatment, some of whom have been returned from open-air treatment in Switzerland as hopeless cases, which have entirely recovered under intensive creosote treatment at home (see page 441). It may be said that the dosage of creosote must be pushed step by step to the full limits of tolerance. I often succeed in getting a child from 2 to 3 years of age to take as much as 1 drachm of creosote in the 24 hours. The creosote should be given in divided doses and suspended in an emulsion of cod-liver oil to which glycero-phosphate of calcium to the extent of 1 gr. (0·06 gm.) per dose should be added. In speaking thus optimistically of drug treatment in cases of pulmonary tuberculosis, I must add this reservation, that drug treatment holds out little prospect of success in the case of infants under 1 year of age who are too far advanced for specific tuberculous treatment, that is to say, in cases which can be diagnosed by means of ordinary physical examination. The prospect is far better after the 1st year, and gets better and better as the child grows older. At 2 years even advanced cases can occasionally be cured.

Abscess of the Lung

This is not a common condition. It may supervene as a result of the coalescence of a number of small foci of suppuration in a broncho-pneumonia, or from the inhalation of a foreign body. An empyæmia discharging from a bronchus does not come strictly speaking within the definition of the term "Lung Abscess."

Treatment. *Prophylactic.* There is none, except the possible removal of a foreign body (see pages 680 and 255), or the successful treatment of a broncho-pneumonia, which might otherwise have ended in abscess formation.

Curative. A genuine abscess of the lung is rarely cured except by means of a surgical operation, unless it is small, circumscribed, and due to a foreign body which has been discharged by coughing or other means. Emptying lung abscesses by aspiration is rarely successful, even though their exact position is correctly determined. The choice of operation must be left to a thoracic surgeon of experience.

Pending an operation the medical treatment may be conducted on the lines suggested for bronchiectasis (see page 261).

Gangrene of the Lung

This is a very rare condition. It may follow a severe septic broncho-pneumonia in a debilitated patient, or result from the presence of a foreign body. The gangrene appears to be due to vascular occlusion, secondary to a septic phlebitis. It is nearly always fatal.

Treatment. This is purely surgical and usually takes the form of an operation conducted in two stages, the first of which consists in opening the pleural cavity and packing it with antiseptic gauze to secure the shutting off of a localized part of the pleural cavity by adhesions which can be used for drainage apparatus. The second part of the operation consists in making an opening in the lung abscess through this shut-off area, and draining it by the insertion of a tube.

Pleurisy

Pleurisy is seldom, if ever, primary in infants or young children. It is practically always secondary to some pulmonary or local infection, such as pneumonia, bronchitis, mediastinal glands, spinal caries, osteomyelitis, or to some general infection, such as septicæmia, measles, scarlet fever, or rheumatism. The nature of the infective organism should if possible be determined by bacteriological examination of the pleuritic fluid, if this can be obtained by the insertion of an exploring needle, for such findings have an important bearing on the probable duration of the illness, on the final prognosis, and of course on the treatment.

In about 75 per cent of all cases, pneumococci are present in pure culture. Streptococcal infections come next in order of frequency, then staphylococcal, and finally the tuberculous and coli varieties. The pleuritic inflammation generally passes through three stages, the dry, the serous, and the purulent, although sometimes these three stages are described as three distinct varieties of pleurisy. The treatment largely depends on the stage to which

the inflammation has reached, and will be described in the following pages of this section.

Treatment. *Prophylactic.* There can obviously be no means of prophylaxis other than that of preventing the primary disease to which the pleurisy is secondary.

Curative. Although the general treatment of all varieties of pleurisy is practically the same, *i.e.* that described under the heading of " pneumonia " (see page 267), the local treatment differs in accordance with the stage.

1st Stage. All varieties of pleurisy pass through the dry stage, though the duration of the latter may be very brief, but it is necessary in all suspected cases of dry pleurisy to exclude the possibility that the case is one of herpes zoster, myalgia, neuralgia, or pleurodynia. In nearly half the cases which I have seen in consultation as cases of " Dry Pleurisy " a mistaken diagnosis has been made. Moreover, I believe that so-called " Epidemic Pleurisy " is in most cases epidemic myalgia, or Bornholm disease (see page 424). The few instances of this rare disease that I have had an opportunity of seeing were at first mistaken for dry pleurisy. Bornholm disease however clears up very quickly and seldom lasts more than 2 or 3 days, whereas dry pleurisy, although some people believe that it can be aborted, never in my experience fails to last a considerable time.

The chief indications for treatment, apart from the management of the parent disease, lie in the relief of pain, and the control of the cough. The pain passes off as soon as the inflamed and tender pleural surfaces are separated by a cushion of serous effusion. For this reason any measure which accelerates progress from Stage 1, to Stage 2, will be of advantage to the patient. This can be promoted to some extent by the application of a mustard or linseed poultice, or of Antiphlogistine spread on lint. I am not particularly fond of leeching, or strapping, in the case of infants or young children, moreover the need for their application is generally very brief, but everything possible should be done to control coughing, which is as a rule a troublesome feature in these cases, although naturally any measure which interferes with the expectoration of sputum in cases in which there is a co-existing pneumonia or bronchitis must not be adopted, without due consideration of the risk. The administration of opium should be pushed quickly to the limits of safety, since this is undoubtedly the best drug for stopping the cough. I generally give camphorated tincture of opium in increasing doses, of from 2–15 minims (0·13–0·9 c.c.), or 1 drachm (3·5 c.c.) of linctus heroin (see page 689) every 4 hours.

2ND STAGE. The second stage, or that of serous effusion, follows on the first stage at variable intervals. The problem of treatment, then, ceases to be one of counteracting the pain, and becomes one of dealing with the mechanical interference with breathing. When the amount of fluid has reached a degree sufficient to interfere with the cardiac or respiratory functions, some at least of the fluid must be drawn off by aspiration or syphonage. The degree of embarrassment can be measured by the following :

(*i*) The amount of dyspnœa.

(*ii*) The extent of displacement of the heart.

(*iii*) The degree of cyanosis, and the area of lung thrown out of use.

The rate at which the effusion takes place very largely determines the degree of the respiratory and cardiac embarrassment. If it takes place rapidly before accommodation has had time to be established the symptoms are severe. On the other hand, if it takes place slowly the symptoms can be so slight as hardly to attract attention. The treatment depends on the severity of the symptoms. Paracentesis will give immediate relief, but there is no object in aspirating the fluid simply because of its amount, but some must be removed if it gives rise to definite symptoms.

The method of removing the fluid is open to a certain amount of choice. On the whole the best way is to use the old-fashioned aspirating bottle with pump attached, but in using this care must be taken that the negative pressure in the bottle is not too high, and the amount of fluid drawn off at one operation is not unnecessarily great. In all cases time should be taken over such aspirations ; if the pleurisy is of a tuberculous nature, no fluid at all should be withdrawn.

3RD STAGE. The third or purulent stage is only reached in a small proportion of cases. Its arrival may be suspected when there is any sudden exacerbation of constitutional symptoms, rise in temperature, respiration and pulse frequency. There may also be some slight œdema in the intercostal spaces which corresponds with the position of the empyema. The diagnosis however can be so easily clinched by the exploring needle that this means of confirmation should never be neglected. In all cases, excepting those of tuberculous origin, the essential treatment of an empyema consists in the evacuation of the pus. The only question is when should the pus be evacuated, and by what means ? The three methods which are at our disposal are :

(1) Open drainage, with or without resection of rib.

(2) Aspiration, followed by open drainage.

(3) Continuous aspiration.

Open drainage is in my experience far the most satisfactory method in the long run, but it should be preceded in the majority of cases by limited aspiration. The date at which the first operation should take place must be delayed until any co-existing pulmonary trouble has cleared up. When this stage is reached the sooner the first aspiration takes place the better. The final operation for resection of rib and insertion of drainage tube may be deferred for some 2 or 3 weeks, unless there are indications that pus is accumulating too rapidly in the chest.

One word as regards the method of continuous aspiration. I have long since entirely given up this method as both troublesome and inefficient. I have on several occasions had opportunities of inquiring first-hand from adult individuals who have undergone this form of treatment what their opinion is of the method. They have all agreed that it is most disagreeable, and that they would never undergo it again. Although infants and young children cannot express their opinions, they always seem to me to be very unhappy and distressed by the restraint imposed by the apparatus.

Anæsthesia. An anæsthetic is not necessary or desirable for simple paracentesis, whether this is carried out by syphonage or by aspiration. It is however always required in those cases in which resort is had to the system of open drainage, and especially so when resection of a rib is necessitated. No form of anæsthesia is entirely exempt from danger in the case of babies and young children, but a general anæsthetic is in my opinion preferable to a local one, especially if it takes the form of gas and oxygen. As a preliminary to the administration of the anæsthetic there should be at least 6 hours' starvation, though glucose solution and bicarbonate of soda, may be given freely.

After Care. This consists mainly in the re-establishment of good health by suitable climatic and dietetic treatment. The local condition demands measures for the re-expansion of collapsed lung, and for the obliteration of the empyema cavity. For both of these purposes active exercise in the open air by inducing deep breathing and temporary loss of breath will do more to expand collapsed lungs than any amount of "trumpet blowing" or playing with coloured water in a Spirometer bottle, devices which are generally recommended. The drainage tube should not be dispensed with until the discharge has quite dried up and the cavity closed up by granulation or other tissue, by the falling in of chest wall, or by lung expansion.

Tuberculous Pleurisy.

There is always a danger that any form of chronic pleurisy may ultimately become tuberculous. Where there is great delay in recovery, without any adequate explanation, tuberculous developments may be suspected. The differential diagnosis between tuberculous and other forms of pleurisy depends among other things on the following points :

1. The discovery of the tubercle bacillus in the aspirated fluid.
2. An excess of lymphocites in the fluid aspirated during the second stage.
3. The slow progress of the disease towards recovery.
4. A positive Mantoux test.
5. X-ray evidence, especially of Hilus glands.

Treatment. The general treatment of a tuberculous pleurisy must be conducted on the same lines as those described on page 275, for the treatment of pulmonary tuberculosis.

As regards local treatment, it must be remembered that aspiration or open drainage is contra-indicated unless there should happen to be any serious cardiac distress and cyanosis, which is very rarely the case.

CHAPTER IX

DISEASES OF THE HEART AND BLOOD-VESSELS

DISEASES OF THE HEART

The subject of heart disease in infants and children presents many difficulties from the point of view of pathology and prognosis, but from the point of view of treatment, there is little to be said. It is proposed therefore to give only a short account of the treatment of carditis in general, with a few special remarks on endocarditis, myocarditis, pericarditis, and special directions for the treatment of individual symptoms and complications such as heart failure, œdema, cyanosis, and irregularity of the pulse, including heart block.

I would however like to record here my conviction that septic and septicæmic conditions in infants and children under 5 years of age are responsible for a great many more cases of endocarditis than is usually believed. Moreover, I consider that rheumatism is far more common at this age than is generally admitted. It is very difficult to accept the view that if rheumatism is, as is now almost universally believed, a form of septicæmia, that infants and children who are particularly susceptible to infection of this sort, should escape its results as far as the heart is concerned. It is generally stated that rheumatism is very uncommon in children under 4 years of age. My own belief is that it is exceedingly common, but that it presents entirely different symptoms from those characteristic of other age periods, and that one of them is almost invariably a swelling of the endothelial lining of the heart and vessels, with subsequent erosions, and in the case of the valves of the heart, vegetations and fibrotic changes. At The Infants Hospital, during the time I was Medical Director, we always made a special search for evidences of valvular involvement in all cases which had died from septic conditions, and very rarely failed to discover some evidence of them.

Congenital Heart Disease

It would be out of place to enumerate here the many defects in the development of the heart which are usually included in

the list of its congenital anomalies. The diagnosis, and especially the assessment of the gravity of the condition, is by no means simple and depends on an accurate appreciation of the electro-cardiographic and X-ray findings, in addition to the degree of cyanosis, and the effect of the circulatory disabilities on the pulmonary, digestive, and excretory functions, as well as on growth and the general nutritional state. Polycythemia is usually present, and although its degree is to some extent a measure of the circulatory embarrassment, it is also compensatory in that it provides for the carriage of additional oxygen to the tissues. Clubbing may also be a compensatory phenomenon, and of teleological significance, because as Dr. Jean Smith has ingeniously suggested, it probably represents an increase in the total volume of the blood in circulation.

Treatment. There is no specific treatment for *morbus cordis congenitalis*. The most that can be done is to provide careful nursing, and to protect the subjects of it from intercurrent infections, such as pneumonia, or influenza, which are common causes of death. In my experience the chief dangers to provide against are over-feeding, exposure to cold, and infection.

All forms of excitement or over-exertion should be avoided. With anginal or " blue " attacks, alternate inhalations of amyl nitrite and oxygen are valuable : so also are opium preparations, if they are used with caution, but digitalis is useless.

The amount of exercise permitted will depend entirely on the degree of cyanosis and dyspnœa resulting from physical exertion. Anæsthesia and surgical operations are not attended with much more risk than in the case of ordinary children, and need not be vetoed on the ground of the heart condition alone.

Acute Carditis

The term carditis is a comprehensive one, covering the inflammatory involvement of all the special tissues of the heart—valvular, myocardial, pericardial, and genetic. It is in fact usually a pan-carditis involving all the tissues of the heart, and in the case of young children more particularly the pericardium. In fact cases of carditis or pan-carditis are often described as pericarditis, owing to the fact that the predominating symptoms are those which are due to the pericardial involvement.

Although the chief cause of carditis in children and others may be what is commonly called rheumatism, occasionally other forms of septic infection associated with the specific fevers, especially scarlatina, diphtheria, pneumonia and influenza, are causative factors.

An acute case of pan-carditis presents a striking clinical picture, which can scarcely be mistaken for anything else. Quite apart from the special or constitutional symptoms due to the parent disorder, there is restlessness, irritability, dyspnœa, cyanosis, enlargement of the liver, dilatation of the heart, rapid pulse, and often œdema.

Treatment. *Prophylactic.* All measures which are efficacious in preventing rheumatism or other septic conditions have an indirect prophylactic influence on carditis itself, *i.e.* such measures as good feeding, housing, suitable clothing, and protection from infection. Early and energetic treatment of the above primary diseases when contracted is of value also in preventing cardiac complications.

Curative. This consists in the treatment by appropriate means of the primary disorder, which is usually either rheumatism, or some septic condition. In the former case by alkaline treatment combined with salicylates, and in the latter by specific serum therapeusis.

The management of the heart condition itself may also be summed up in one word—"rest," both physical and mental. The child must be protected from all sources of reflex disturbance which can in any way embarrass the heart's action, such as that due to excess of food or fluid, indigestion, flatulence, constipation, pain, or physical exertion. He should be kept in bed in a recumbent or semi-recumbent position, and the deleterious effects of such enforced immobilization on muscular tone and efficiency should be compensated for by massage of the limbs, and very carefully controlled resistance exercises.

Cardiac stimulants are seldom required except in emergencies, when camphor ($\frac{1}{4}$ gr. in oil) may be administered hypodermically, or coramine (Ciba) given orally to the extent of 3 minims, or hypodermically ($\frac{1}{2}$ ampule). Both these drugs are probably better than either strychnine, strophanthus, or digitalis. For serious emergencies the hypodermic injection of 1 to 3 minims of 1 in 1000 adrenalin solution might be tried to tide the child over a difficulty, but it should not be repeated too often.

Nerve sedatives are extremely useful to relieve cardiac distress and prevent a rise in blood pressure due to fear, excitement, or anxiety, and of these bromide is in my opinion the most valuable, and it may be given in comparatively large doses up to 10 grains. Opium in the form of nepenthe (minim 1), or tincture of camphorated opium (minims 4) is of all drugs the most useful to relieve cardiac distress. Local applications to the heart, especially in those cases in which the pericardium is involved, are very useful,

and may take the form of hot fomentations, ice-packs, painting with glycerine of atrophine (B.P.C.), or poultices of kaolin (Cataplasma Kaolin : B.P.). Dilatation of the chambers of the heart may be relieved by the application of two or three leeches to the precordium, or to the liver area when there is great distension of the right heart. In my student days, we followed Dr. David Lees's practice of applying an ice-bag to the precordium in acute cases of carditis or pericarditis, especially in cases of effusion, and I must admit that this line of treatment gave more relief than many of the more modern practices, but if the ice-bag is used for this purpose it must be well supported and suspended from a cradle, so as not to embarrass the cardiac movements.

The length of time a child should be kept in bed in cases of carditis is always one of the most anxious considerations, certainly as long as there is any evidence of activity of the rheumatic process in the heart itself as shown by dilatation, tachycardia, and muffled sounds at the apex. The most valuable guide in enabling one to decide when restrictions of movements should be relaxed is the response which the heart makes to calls made upon it under conditions of exertion. If, when the child makes moderate physical efforts in sitting up, turning over in bed, or getting out of bed the pulse frequency is not noticeably increased, greater efforts may subsequently be allowed, but the results should always be carefully noted, especially as regards pulse and heart sounds.

As the child recovers and reaches convalescence, the management of the case still presents great difficulties. The degree of breathlessness on exertion, and the amount of dilatation of the chambers of the heart must be carefully watched, but in my opinion, quite as much harm is done by keeping the child too long in bed and making an unnecessary invalid of him as by the premature abandonment of precautionary measures. In order that full compensation may be acquired, the heart must be occasionally given additional work. If constantly kept working on the lowest possible level it has few opportunities of acquiring reserve powers or making up for lost opportunities of development.

Endocarditis

In its acute form endocarditis does not in itself produce any serious symptoms in infants or young children, unless it is complicated by myocardial or pericardial involvement, but the primary disorder on which it is dependent, usually some general blood infection, may be responsible for other serious pathological consequences.

Septicæmic conditions in babies and young children, especially in the former, generally kill before fibrotic changes in the valves have had time to become established, and it is for this reason, I believe, that endocarditis and valvular disease is believed to be so uncommon at these ages. Inflammatory changes in the lining endothelium of the heart and valves are in my experience not only exceedingly common, but almost universal in cases of septicæmia in infants and young children, although during life auscultatory and other evidences of the condition may not be forthcoming. The more chronic results of endocarditis with fibrotic changes in the valves, producing cardiac murmurs and impediments to the circulation, are not likely to escape detection. The commonest forms are stenosis and insufficiency of the mitral valve, although the pulmonary, tricuspid, and aortic orifices are also occasionally involved. Each of these presents its own characteristic group of physical signs and symptoms which need not be described here.

Treatment. There are certain therapeutic measures which are common to all forms of endocarditis, and these include of course the treatment of the primary disease, and general management.

In all cases complete rest must be enjoined during the acute stages, together with due attention to feeding, the state of the bowels, and the provision of fresh air and access to sunlight.

In the following paragraphs the special indications for the treatment of the individual lesions will be briefly outlined.

Mitral Regurgitation

Slight degrees of regurgitation with stretching of the mitral ring can occur in the early stages of inflammation of this valve, but mitral leakage is more likely to occur as a latter result of fibrotic changes, shortening of the chordæ tendineæ, thickening of the valve segments, and deformity of the orifice. Although mitral disease is the more frequent form of endocarditis in infants and children, it is by no means common under 5 years of age as an acquired condition.

Treatment. *Prophylactic.* None, beyond the prevention of the primary disease; rheumatism or septicæmia are the chief predisposing causes.

Curative. In the acute stages complete rest is essential, and relief of mechanical strain on the circulation by the administration of nerve sedatives, such as bromide and opium; by the avoidance of excess of either food or fluids; and by the regulation of the bowels.

In the chronic stages, after all active evidences of the primary disease have disappeared, attention must be directed to the

question of myocardial compensation, but compensation is not likely to be secured by giving indefinite relief to the heart by long-continued and uninterrupted rest after the cessation of the inflammatory process. No muscle can grow stronger by rest alone. Hypertrophy can only be attained by the exercise of function. In all cases in which compensation is required, the heart must be given a certain amount of work to do, beyond the routine requirements of the circulation, but the great difficulty in these cases is to know how much extraneous exercise to allow, and at what time. This question can only be answered by experiment and trial. During early convalescence the child should be allowed greater opportunity for independent exercise, such as sitting up in bed, turning over, or even standing up. The effect on the heart and pulse must be carefully noted at each advance, especially with regard to the time required after such exertions for the heart and pulse to recover and resume their normal condition. The frequency of the pulse and the size of the left auricle both serve as useful guides.

It is during convalescence that heart tonics such as digitalis and strophanthus are particularly helpful. With every increase in the amount of exercise allowed, there should be a simultaneous administration of digitalis or its equivalent, and such periods should be followed by short intervals of rest lasting 2 or 3 days, during which time the cardiac tonic may be omitted. With such alternating periods of increased exercise with heart tonics, and periods of rest without them, compensation may be slowly established.

Mitral Stenosis

This is a rare condition in children under 5 years of age. It may however result from an early endocarditis which has left some fibrotic contraction of the valves and mitral ring. Such a condition is permanent, though not progressive, although the stenosis may become apparently greater owing to the general increase in size of the heart as development proceeds, while the mitral valve remains unchanged.

Treatment. *Prophylactic.* None, except that of the underlying disease, whether rheumatism or septicæmia.

Curative. The aim of treatment is to secure muscular hypertrophy of the left auricle in order to drive the blood through the narrowed orifice. Compensation of this kind can only be acquired slowly by a course of gradually increasing physical exercise, combined with heart tonics, such as digitalis or strophanthus, followed by periods of rest without these artificial aids. Back

pressure in mitral stenosis occurs in the pulmonary areas and predisposes to congestion of the lungs, bronchitis, and cough. Such complications must be treated by physical rest and relief of the circulation by leeching in the intrascapular region, also by purgatives, diuretics, and limitation of the intake of fluid.

Aortic Regurgitation

Although comparatively common in adolescents, aortic regurgitation is rare in children under 5 years of age, but slight degrees of the trouble may be due to weakening and relaxation of the valvular ring from an existing endocarditis of rheumatic or septicæmic origin.

Treatment. *Prophylactic.* None, except that of the prevention of the primary conditions, namely, rheumatism and septicæmia, which give rise to the endocarditis.

Curative. With regurgitation of blood from the arterial system into the left ventricle during diastole, it is clear that this chamber of the heart must dilate to accommodate the increased quantity of blood, but the ventricular wall must also hypertrophy if compensation is to take place. This can be best secured by the application of the principles already described under mitral disease, of periods of gradually increased exercise with heart tonics, alternating with periods of rest without tonics. The tonic of election however is not digitalis, for this drug tends to slow the heart's action and prolong diastole, and thus to give better opportunities for regurgitation. Nux vomica, caffeine, or coramine, are more suitable for the purpose. Adrenalin, although of use as a temporary heart tonic, has the disadvantage of increasing blood pressure, and thus adding to the burden of the left ventricle.

Aortic Stenosis

The acquired form of aortic stenosis is extremely uncommon in children under 5 years of age. It is characterized by a systolic murmur at the base of the heart in the first right interspace, and is conducted into the neck. A thrill, which can be felt by the hand placed over the area of greatest intensity, is generally present.

Treatment. *Prophylactic.* None, except that of the primary disease, for the most part rheumatism or sepsis.

Curative. Hypertrophy of a dilated left ventricle is the natural means of compensation in cases of aortic stenosis. It can best be secured by slow degrees under the favourable circumstances of skilfully conducted exercises alternating with periods

of rest, as described in the section which deals with mitral stenosis (page 287).

Tricuspid Regurgitation

This lesion is also rare under 5 years of age, and is usually secondary to some congenital defect in the inter-ventricular or inter-auricular septum, and is one of the sequelæ to back pressure in the pulmonary circulation, though it may be part of a general carditis due to rheumatism or other infection. It is accompanied by a diffuse weakening of the myocardium, and is characterized by enlargement of the liver, and in extreme cases by a perceptible pulsation in this organ. There is also sometimes distension of the large superficial veins of the neck, thorax, and abdomen.

Treatment. *Prophylactic.* None, except that of the primary condition which gives rise to the toxæmia or stretching of the valvular ring.

Curative. This consists in relieving the venous congestion by limitation of the intake of fluid, by purgation, diuresis, physical rest, phlebotomy, or the application of leeches to the liver. Cardiac stimulants are of little use as they act mostly on the left side of the heart, but camphor ($\frac{1}{4}$ gr.) in oil, injected hypodermically, or a few drops of coramine by the mouth may give some relief.

Tricuspid Stenosis

This is also a very rare condition in children under 5 years of age, except as a congenital abnormality. When it occurs it is nearly always secondary to rheumatism or other septic infection. The results are dilatation of the right auricle with back pressure on the liver and venous congestion.

Treatment. The treatment is the same as that for tricuspid regurgitation.

Pulmonary Regurgitation and Pulmonary Stenosis

Except as congenital lesions these very rarely occur in children under 5 years of age, and require no special description here.

Myocarditis

Although the toxæmia of rheumatism is generally regarded as the common cause of myocarditis, uncomplicated cases—that is to say, without endocarditis or pericarditis—are far more commonly due in children to some acute infection, such as diphtheria, scarlatina, influenza, or typhoid. Although the effects of a

myocarditis due to the latter causes are as a rule quite temporary, the symptoms are often very alarming during the acute stages, and take the form of heart failure, with increased pulse-rate, and feeble heart sounds at the apex of the " tic-tac " type. A mild systolic murmur may be heard over the apex, with disturbance of rhythm, while faintness may occur on the least exertion.

Treatment. *Prophylactic.* Prevention consists in the avoidance of the primary disease, and by careful nursing should the latter occur.

Curative. This may be considered from three points of view :

(1) During the acute stages when complete rest must be enjoined.

(2) The stage of recovery where there is cessation of the active phase of the primary disorder.

(3) Convalescence.

During the acute period attention must be devoted to the primary disease, which in children under 5 years of age is mainly rheumatism, or septicæmia. If constitutional symptoms and pyrexia last more than a month and there is no other septic condition to account for them, it may be concluded that the primary disease is rheumatic in nature, although the classical symptoms of this disease may be absent. In all cases primary foci of infection must be searched for, such as unhealthy tonsils, sinusitis, or middle ear disease, and if found, appropriately treated. During the whole of this period the child must be kept at rest in bed, with full access to fresh air and sunshine. He must be kept quietly amused, but disturbed as little as possible for the necessary operations of changing of clothes, making the bed, or relief of the bowels.

During the second and third stages when there should be a return to a more normal mode of existence, and when convalescence commences, the chief concern should be the rate at which restrictions on exercise should be relaxed, and the amount of physical exertion allowed. This will depend very largely on the degree of breathlessness which follows on exercise. Short of actual breathlessness the amount permitted may be gradually increased, until under favourable conditions the full amount usually indulged in by a normal child is reached. During this period there is usually no necessity to resort to drug treatment, but the best possible hygienic conditions compatible with the circumstances should be provided.

Drug Treatment. Apart from the salicylates or other specific treatment of the underlying condition, few drugs are required during the acute period, except possibly nerve sedatives, such as

bromide, to keep the child quiet and provide sleep, and semprolin or some other mild aperient to keep the bowels in a suitable condition of relaxation.

Pericarditis

Although pericarditis can exist in infants and young children as an independent pathological entity, it generally constitutes the predominant feature in a general pan-carditis. When a child suffering from rheumatism suddenly becomes worse for no apparent reason, pericardial involvement should be suspected, especially if there is a *pulsus paradoxus*—that is to say, a pulse which becomes feeble or unrecognizable during the inspiratory phase. Additional evidences of pericarditis are presented by pain over the precordium, which is increased on pressure; and extension of the precordial dullness outwards in the 2nd left inter-space, and to the right above the upper border of the liver. The impulse is often lost in the position in which it might most reasonably be expected to be present, and may only be felt in the upper limits of dullness. Further, there may be collapse of the lung at the left base with difficulty in swallowing. X-ray evidence, especially on screening, is a reliable aid to diagnosis.

Treatment. *Prophylactic.* None, except that of the primary disease, usually rheumatism.

Curative. During the acute stages complete rest is the most important element in the treatment. As a rule the child is more comfortable in a semi-recumbent position, supported by pillows or a bed-rest, than when lying flat on his back. A water mattress or air-cushion is important to prevent bed-sores from the continual pressure on the buttocks, owing to the complete immobilization of the patient in one fixed position.

Although the child must be kept warm, he should have plenty of fresh air from an open window if the weather conditions allow, or in the summer time he may be wheeled on to a balcony or into the open air. Natural irradiation from the sun is a great help to recovery.

The diet should be extremely simple, consisting for the most part of fruit, vegetables, cereals, and farinaceous foods. Meat, fish, and eggs, should be reduced to a minimum, and not more than 1 pint of milk allowed in the 24 hours. Over-feeding and over-consumption of fluid should be avoided.

The bowels which tend to become constipated owing to the enforced inactivity, should be regulated by adequate doses of a petroleum emulsion, such as semprolin, of which 1–3 teaspoonfuls should be given in divided doses in the 24 hours, or a corresponding

amount of Petrolagar. The administration of calomel, or even saline aperients, so often prescribed in these cases, is in my opinion undesirable, as both tend to lead to a reactionary constipation, which is serious in so prolonged an illness as pericarditis generally proves to be.

Nerve Sedatives. These are nearly always required to combat restlessness, and sleeplessness, and to relieve cardiac distress or pain. Opium of all drugs is the most valuable for these purposes, but it must be used sparingly owing to the chronic course which pericarditis usually runs. It is best to give it in the form of Nepenthe, 1 minim three times a day is usually enough. Bromides if used should be given freely to the extent of 5 or 10 grains three times daily.

Local Treatment. This often gives relief. Leeching the precordium is useful in emergencies, or at the beginning of the illness. Kaolin poultices (Cataplasma Kaolini B.P.) are also comforting and the application of an ice-bag to the precordium is an old-fashioned line of treatment which has much to be said for it. Paracentesis is rarely required since the effusion of fluid in the sac is a conservative process which serves as a convenient cushion between the inflamed surfaces of the pericardium and prevents friction, pain, and adhesions. If the effusion is sufficient to embarrass the heart's action, a small aspirating needle should be inserted into the 5th right inter-space about 1 inch from the sternum. There is no danger in this operation even if the heart is penetrated, for the relief afforded to this overburdened organ by the loss of an ounce or two of blood is very considerable, as I have had occasion to note on more than one occasion in which an exploring needle has been deliberately inserted into the right ventricle.

Cardiac failure may be met by digitalis, unless otherwise contra-indicated, by coramine, or alcohol, as recommended on page 295.

Suppurative Pericarditis and Pyo-pericardium.

This is a rare complication of pericarditis, and is practically never met with in ordinary forms of rheumatic pericarditis. It may however occur as an extension from a pneumococcic infection of the lungs and pleura, or as part of a general tuberculous pleurisy.

The diagnosis may be extremely difficult in cases of pneumonia, in which the overwhelming symptoms of the pulmonary condition dominate the whole clinical picture. The absence of cardiac impulse, the presence of *pulsus paradoxus*, and feeble heart sounds, with more or less cantering rhythm, may direct attention to the

possibility of pyo-pericardium, but in any case of doubt the exploring needle should be inserted into the 5th right inter-space.

Treatment. *Prophylactic.* There is none, excepting prevention of the primary diseases.

Curative. The treatment is the same as that for empyema—that is to say, by repeated aspirations, or by open drainage with the insertion of a tube, but the danger of heart failure must not be neglected, and should be met by appropriate doses of digitalis, as recommended on page 295.

Heart Failure

Heart failure is most likely to occur in children under 5 years of age who are suffering from myocardial involvement due to some infective toxæmia, such as that of diphtheria, pneumonia, influenza, or typhoid. It is comparatively rare in cases of rheumatic endocarditis. It occurs especially in those cases in which the heart has already been damaged by some pre-existing trouble, especially when its mechanical efficiency has been impaired by a gross congenital defect. The evidences of heart failure are dyspnœa, cyanosis, œdema, enlargement of the liver, oliguria, cough, restlessness, and irritability.

Treatment. *Prophylactic.* Prevention depends chiefly on protecting the child who has an already damaged heart from undue physical exertion. There can be no doubt that digitalis wisely employed in suitable cases is a valuable prophylactic agent against heart failure in those cases in which this catastrophe may be reasonably expected.

Curative. The rational treatment of heart failure involves two important therapeutic principles—first, the relief of mechanical strain on the circulation, and secondly, an increase of myocardial efficiency.

The first of these objects is obtained by enjoining complete rest in bed in a semi-recumbent position, supported by some form of bed-rest, with the feet elevated by raising the foot of the bed. Full provision must be made for free access of fresh air, which should not be below a temperature of 60° F., and if possible not above 68° F. Both high and low temperatures of the respired air are unfavourable in the treatment of cardiac failure. Cool air and moving air are both stimulants to general metabolism, and incidentally to the heart. In very serious cases the administration of oxygen may be justified by the presence of dyspnœa, cyanosis, and feeble pulse. It should be administered by means of a flexible catheter passed about 1 inch through one nostril

and kept in position by strapping applied to the face, or by means of safety-pins fixed to the clothing. The oxygen cylinder which supplies the gas should be connected to a decompression valve which leads to a Woolf's bottle in which the oxygen bubbles through water warmed to a temperature of 100° F., and containing a small quantity of brandy. The supply should be so regulated as to allow the oxygen to bubble through the water at the rate of 2 or 3 bubbles per second.

The bowels should be regulated by means of adequate doses of Semprolin (Petroleum Emulsion), a precaution which is usually required owing to the confinement in bed, and the restricted quantity of the diet.

Diet. The diet is of importance : it should be light and easily digested, also small in amount. Many infants and young children suffering from heart failure owe their deaths to efforts to " keep up their strength " by unduly large quantities of food. The diet should consist of beef-tea, veal broth, chicken and other meat jellies, Benger's Food (see page 709), grapes, oranges, barley-water, custards, eggs and chicken, and dry toast and biscuits, if the child is old enough and well enough to masticate these thoroughly. It is a mistake to make the diet too exclusively fluid, but considerations of mastication must determine how much solid food it is safe to allow. Little luxuries, such as milk chocolate, barley-sugar, water ices, weak tea, sherry whey, and Punch Romaine, are often greatly appreciated by children confined to bed for heart failure, and if not given in excessive amount, can do no harm. The important element in the feeding is to give small quantities at relatively frequent intervals ; although as a general dietetic principle I am very much opposed to the " little and often " principle, in the particular case of heart failure I regard it as being almost essential, since the effects of taking large quantities at a time to try and strengthen the patient, can cause cardiac embarrassment by distension of the stomach.

Alcoholic stimulants are indicated for emergencies, but they need not be limited to brandy. Sometimes young children take alcohol in the form of cherry brandy, sloe gin, sherry, cocktails, or even champagne, better than they take plain brandy. As a rule stimulants are given to young children in too small quantities to be of any practical value. For a baby 1 year old, between 10 and 15 drops of brandy, or its alcoholic equivalent in some other form, is not too large a dose, if given three or four times in the 24 hours.

Both leeching and venesection are of great value in cases of heart failure with cyanosis, but great care must be taken in

applying these remedies not to frighten the child, and thus raise the blood pressure. Sufficient blood can sometimes be withdrawn from a prominent vein by means of a fine exploring needle and syringe, without having to resort to either phlebotomy or leeching.

Nerve sedatives, such as bromide, chloral, or opium, are all extremely useful in the relief of restlessness, and in the obtaining of sleep, but if they are given too freely they may have their pathological repercussions.

Cardiac Tonics. The second means by which we can combat cardiac failure, namely, by the direct action of cardiac tonics acting on the musculature of the ventricles, is in the case of children under 5 years of age extremely disappointing. The fact that heart failure in such cases is usually due to myocardial weakness and not to valvular defects may be the explanation of this common experience, for it is worse than useless to flog the muscle fibres of the cardiac chambers with digitalis or other form of heart tonic, when owing to exhaustion they are unable to afford any response. The most important precept upon which to act in respect of the use of digitalis in cases of heart failure in young children, is that it should never be employed while there is any evidence of active inflammatory mischief in the structures of the heart, or indeed, while pyrexia and other constitutional symptoms persist. On the other hand, digitalis is extremely useful in disturbances of the sino-auricular node, with tachycardia. Its application in such cases will be considered on page 208.

Since digitalis as a heart tonic is contra-indicated in the majority of cases of cardiac failure in young children, we are left with a very meagre list of drugs which are helpful in assisting the myocardium to play its part. I am inclined to think that, apart from alcohol, which probably acts more by relieving the resistance of the peripheral circulation, than by any direct action on the heart itself, coramine, caffeine, camphor, adrenalin, and nux vomica, are the only drugs which have any reasonable value in overcoming the objective signs of heart failure. Adrenalin is perhaps the most useful of these in emergencies, but it must be remembered that what it may give with one hand, it may take away with the other, for it tends to increase blood pressure as well as improve cardiac tone, and by so doing only increases the work of the left ventricle. It should therefore always be used with caution, and given in small doses at first unless its value has been proved. One or two minims of a 1 in 1000 solution given hypodermically is an initial dose.

Dyspnœa

Dyspnœa is usually the first sign of heart failure, but it may be due to many other causes quite unconnected with cardiac trouble, as for instance, acidosis, asthma, anæmia, respiratory obstruction, or nervous troubles. It is of importance however that the correct diagnosis of breathlessness should be made. In cardiac failure the dyspnœa is caused by an excess of carbonic acid in the blood, which over-stimulates the respiratory centre. This excess may be due to failure to maintain pulmonary ventilation, or to stagnation of blood in the systemic circulation.

In acute cases of carditis, dyspnœa must be regarded as of serious import, since it is generally due to the supervention of pericarditis or myocardial exhaustion, and in chronic cases it is also serious because it is an indication of failure of compensation.

Treatment. *Prophylactic.* Preventive measures include all those expedients which are employed to avoid cardiac failure, but since breathlessness is generally one of the first of the symptoms of the latter condition, it may develop unexpectedly and without premonition. Steps should however be taken to protect a damaged heart from all forms of physical strain.

Curative. The degree of breathlessness on exertion, and the time taken for recovery, are a measure of the damage inflicted on the heart, and the degree of compensation established. All the procedures mentioned in the section on the management of heart failure apply also to the treatment of dyspnœa, but unless the breathlessness is accompanied by other serious symptoms which point to extensive damage of the heart, or to threatening breakdown of the cardiac mechanism, they need not be too rigorously employed.

If the dyspnœa passes off quickly with rest, there is no need of further treatment except to provide for ultimate compensation by means of graduated exercise. On the other hand, if the dyspnœa remains the dominant symptom and its degree is out of proportion to the other indications of heart failure, the possibility of some independent complication, such as asthma, acidosis, anæmia, or pulmonary involvement, must be considered, and the whole case reviewed from this aspect, and if such complication be found it must be treated appropriately.

Breathlessness from myocardial weakness must always be regarded seriously, and treated with all those measures laid down for heart failure. Special points however to which I would draw attention in the treatment of dyspnœa, apart from other symptoms of general heart failure, include the following :

(1) The resumption of the orthopnœic position.

(2) Strict limitation of food to physiological proportions.

(3) Adequate supply of oxygen by either natural or artificial means.

(4) Correction of any possible deficiency in the carbonate reserves by means of adequate doses of bicarbonate of soda.

(5) Treatment of anæmia by iron.

Cyanosis

Cyanosis is more characteristic of the congenital variety of heart disease than it is of the acquired form, but when it does occur in the latter, it is as a rule an indication of pulmonary disease or congestion, or that the right heart is embarrassed, and as such it is of serious import, and perhaps more difficult to treat than other symptoms of heart failure.

Treatment. *Prophylactic.* There is no practical means of preventing the cyanosis of heart failure, other than that directed to the prevention of the heart failure itself.

Curative. In view of the fact that cyanosis is so often due to pulmonary obstruction and embarrassment of the right heart, digitalis is often of greater use in these cases than it is in those or primary myocardial trouble, and therefore it should be tried tentatively. Good results from its use cannot however be expected immediately, but only after the lapse of a few days dating from the commencement of treatment.

Oxygen may also be supplied as directed on page 722. When cyanosis is accompanied with demonstrable pulmonary involvement, such as congestion or catarrh, cupping or leeching of the inter-scapular area often gives relief.

Œdema

Some degree of œdema, or water-logging of the tissues is quite common as secondary to heart failure, but serious degrees of it are not usual in children under 5 years of age. It may be accompanied by passive congestion of the kidneys, oliguria, albuminuria, or even hæmaturia.

Treatment. *Prophylactic.* Since œdema is most likely to occur when the excretion of water by the kidneys fails to keep pace with the intake, it seems fairly obvious that some attempt should be made to control the amount of fluid consumed, as a prophylactic measure in cases of heart failure which may possibly result in œdema.

Curative. Limitation of the fluid intake always appeals to me

as the most important element in the treatment of cardiac œdema, and should be pushed to the extent of 30 or 40 per cent below normal, and in addition a salt-free diet must be provided. A certain amount of relief to the anasarca can be expected, however, from the administration of diuretics, and for this purpose a large number of drugs are available, such as urea, caffeine, diuretin, Theocin (Bayer), or the newer preparations Novasurol, and Salgyran. Personally, I have had better results with caffeine or diuretin, than with other drugs; moreover, they are little liable to disturb digestion. The dosage of caffeine should be 1 gr. and that of diuretin 5 gr., either of them to be given three times in the 24 hours.

In these cases the expediency of giving digitalis should be fully considered. In cases of acute heart failure with myocardial enfeeblement as the dominating feature, it may be unwise to attempt to stimulate the exhausted muscle of the heart to greater effort by such means, but clinical experience is veering round to the view that the taboo on digitalis in cases of heart failure with tachycardia from rheumatic or other causes, has been overdone, and that this inestimable heart tonic should in spite of theoretical objections be tried tentatively in small doses for a few days, and if found satisfactory, increased up to the limits of tolerance.

With very extensive œdema or ascites, drainage by Southey's tubes, or incision may be justified, but these procedures should only be adopted as a last resource, as they give rise to considerable discomfort and may pave the way for septic infection.

Enlargement of the Liver

Enlargement of the liver is one of the common symptoms of long-continued heart failure, but it is less liable to occur in the case of children under 5 years of age than in older individuals. It is due primarily to failure of the left ventricle to drive blood through the hepatic arteries, but it is also largely dependent on back pressure through the venous system, exercised by the over-distended chambers of the right heart. Occasionally a pulsation can be felt in the liver which synchronizes with the beats of the heart, and is conducted along the engorged hepatic veins and inferior *vena cava.*

Treatment. *Prophylactic.* None, beyond that of the primary heart failure.

Curative. Congestion of the liver can to some extent be relieved by leeching over the hepatic area, by venesection, or by cupping, or perhaps better by purgation which relieves portal congestion. For this purpose Guy's pill, which is composed of

mercury, digitalis, and squills, is extremely useful, but not a convenient form to administer to children under 5 years of age. A quarter of a pill is about the appropriate dose for a child 1 year old, and it may be given after mashing up with a small quantity of honey, or some other convenient vehicle. The reaction of the heart muscle to digitalis must in this case, as in all others of heart failure, be very carefully watched. The limitation of fluid has the same beneficial influence in the treatment of an enlarged liver, as it has in relieving œdema.

Heart Block

Heart block is not so common in children under 5 years of age as it is at a later date. It does however occur in a certain proportion of cases of congenital heart disease, and occasionally in acquired carditis. It is due to the partial or complete dissociation between the auricle and the ventricle by interference with the bundle of His, which may be thrown out of action by the toxic influence of rheumatism, or other infective disorder, such as diphtheria, meningitis, or pneumonia. The failure of conduction may take effect regularly every second, third, or fourth beat, or it may be irregular and occur only occasionally. In limited cases heart block may be difficult to diagnose without electro-cardiographic records, but with prolonged standstill of the ventricles and loss of consciousness the diagnosis is clear.

Treatment. *Prophylactic.* There is no known means of preventing heart block other than by avoiding the primary condition, which if not congenital, usually takes the form of a rheumatic, diphtheritic, or pneumonic toxæmia.

Curative. Apart from the treatment of the underlying condition, management of these cases depends on the hypodermic injection of 2 to 4 minims (0·13 to 0·26 gm.) of a 1 in 1000 solution of adrenalin. This method of treatment has almost entirely superseded the use of atropine, which on theoretical grounds might be expected to be efficacious by cutting off vagus impulses, and thus giving full play to sympathetic control. As the effect of adrenalin is very transitory, the injection must be repeated at short intervals. A more sustained, but somewhat similar effect can be produced by ephedrin, which may be given in doses of $\frac{1}{4}$ gr. (0·032 gm.) by the mouth, and repeated at six-hourly intervals, or the same drug may be given in the form of the Elixir : (Elixir Ephedrinæ Hydrochloridi (B.P.C.)) to the extent of 15 minims (0·9 c.c.).

Paroxysmal Tachycardia

Attacks of paroxysmal tachycardia may occur without any discoverable cause, but more frequently as the result of some emotional disturbance, such as fright, shock, or excitement. The seriousness of the condition is largely dependent on whether or not an exciting cause can be found, or one which is adequate to explain the condition. If no causes, or no reasonable causes can be discovered for the paroxysms, and if the latter are of long duration, there are grounds for anxiety.

Treatment. *Prophylactic.* The avoidance of exciting causes, whether physical or emotional, which are calculated to precipitate an attack, and the continued use of bromides and other nerve sedatives, are effective in preventing the milder forms of attack in nervous children.

Curative. This consists in rest, both physical and mental. The administration of nerve sedatives, such as bromide, chloral, or opium, and in the pushing of digitalis up to the limits of tolerance : 5 minims of the standardized tincture of digitalis given three times a day, is as a rule sufficient as an initial dose, or Nativelles Digitaline solution [1] (5 minims) may be injected hypodermically.

DISEASES OF THE BLOOD-VESSELS

Diseases of the Arteries

Gross disease of the arteries is uncommon in children under 5 years of age, but cases of arteritis, both acute and chronic, have occasionally been recorded, as well as of aneurysms. It is however probable that both in septicæmia and in other general blood infections the intima or endothelial lining of the arteries as well as of the cavities of the heart, may undergo degenerative changes, or cloudy swelling, which, if long continued, may lead to permanent pathological changes, and, in the case of the arteries, thickening of their wall.

Arterial spasm is also probably common in young children, giving rise to a variety of symptoms, according to the situation of the resulting local ischæmia. Cold feet, for instance, are probably due to this cause—the condition commencing first as a protective reflex to drive the blood into the interior of the body where it is warmer, and subsequently becoming a fixed and persistent vasomotor habit.

[1] This solution may be obtained from Wilcox Jozeau, London.

Arteritis

Acute arteritis occasionally occurs in severe cases of infection, such as general septicæmia, typhoid, scarlatina, and diphtheria. It is particularly common in the case of umbilical sepsis in the new-born. It may occur as a rare event in congenital syphilis. I had a case of this kind in a new-born infant in which there was so severe an arteritis and thrombosis of certain vessels that gangrene resulted. Fig. 19 shows the stump of the left thigh

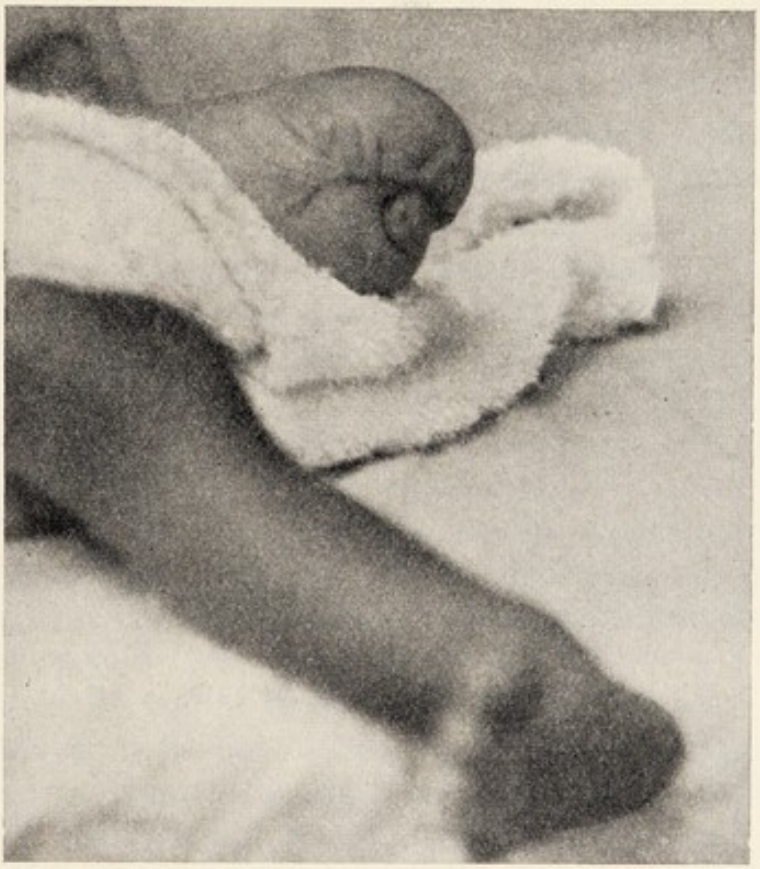


FIG. 19.—Syphilitic Arteritis in new-born infant, resulting in Gangrene and spontaneous amputation of left leg.

after loss of the corresponding leg through gangrene. Both buttocks also became gangrenous. Under anti-syphilitic treatment this child recovered.

Treatment. *Prophylactic.* None, other than that of the underlying condition.

Curative. There is no satisfactory means of treating arteritis, beyond that of rest and complete immobilization of the part affected, which, should thrombosis occur, prevents detachment of the clot and consequent embolism. Large doses of hexamine (6–10 gr.) three times a day may be tried in cases of septicæmia, or special serological methods if the infective organism can be

identified. Fomentations with glycerine of atropine will relieve pain if such be present, while citrate of soda and potassium iodide may be given to keep the blood liquid and prevent the formation of a clot.

Phlebitis

This is not very common in children under 5 years of age, except in the form of a septic omphalitis in new-born infants, or a thrombosed cerebral sinus, secondary to middle ear disease. Any vein however may become the seat of inflammation in the course of such infections as typhoid fever, or pneumonia. Septic phlebitis is nearly always fatal.

Treatment. *Prophylactic.* None, excepting prevention of the primary condition which gives rise to the inflammation of the vein.

Curative. In cases of phlebitis and thrombosis of the lateral sinus, the latter must be opened up by trephining, and plugged with antiseptic gauze. In cases of inflammation of any other cerebral sinus little can be done.

In the case of umbilical phlebitis the suppurating track should be opened up as far as possible and thoroughly drained. Since the inflammation, however, generally travels along the round ligament to the liver, giving rise to multiple hepatic abscesses, there is little hope of a cure by any line of treatment.

Raynaud's Disease

This complaint is now generally regarded as a spasmodic neurosis of the sympathetic system, affecting for the most part the blood-vessels of the extremities, and giving rise to local syncope, asphyxia, or in extreme cases gangrene. It is possibly an exaggerated form of a condition which is very common in infants, in which the feet and hands, more especially the former, turn blue and cold on the slightest exposure, a condition which is very apt to become an established habit if it is not immediately treated and cured.

Typical cases of Raynaud's disease are very rare in children, but adult instances of the disease can generally be traced back to small beginnings in childhood, in which premonitions of what ultimately develops are forthcoming in the form of blue extremities on the slightest exposure to cold.

Treatment. *Prophylactic.* If the above view is correct, namely, that a simple local blueness of the extremities may, if allowed to persist or occur sufficiently often, finally develop into a chronic condition, a great deal should be possible in the way

of prophylaxis against such an event by taking precautions to prevent the establishment of an early vasomotor neurosis, of the kind referred to above. For this reason the hands and feet of new-born infants should be most carefully protected from cold by means of suitable gloves or socks, or by hot-water bottles.

I think that every case of constantly recurring cold feet and hands in young babies should be regarded as a potential forerunner of Raynaud's disease, and that suitable prophylactic measures should be taken to prevent the early manifestation of vaso-constrictor symptoms. The choice of a suitable climate, such as South Africa, North Africa, or the Canaries, is in my opinion much the most valuable element both in the prophylactic and in the curative treatment.

Curative. The main elements in the rational treatment are protection from cold, and a suitable climate. During an actual attack, drugs such as nitroglycerine, sweet spirits of nitre, thyroid or Padutin (Bayer) are useful in their respective spheres, but I have never seen any patient derive benefit from galvanic treatment or from immersion of the hands and feet alternately in hot and cold water, a method which is sometimes of use in the analogous conditions of chilblains or acrodynia (Pink disease).

I do not attach much importance to the use of cod-liver oil, but the vitamin B complex in the form of Bemax or Marmite seems to me to hold out possibilities of successful treatment in the same way that it does in *acrodynia* (Pink disease), which has certain features in common with Raynaud's disease. Radiant heat baths are also sometimes of use.

CHAPTER X

DISEASES OF THE BLOOD

DISEASES AND ABNORMALITIES OF THE RED BLOOD CELLS

The classification of the anæmias as " primary " and " secondary " is practically obsolete, and it is now generally recognized that all forms of anæmia may be grouped in one or other of the following categories :

1. Those due to a diminished or abnormal red blood cell formation.

2. Those due to increased red blood cell destruction, or to damage of the erythrons (erythronoclasis).

This classification is based on exact cytological and hæmological information, which enables the pathologist to assign any particular variety of anæmia to its appropriate group, in accordance with the number, size, colour, shape and general characteristics of the red cells, almost without reference to the clinical history or symptoms. Thus, if the erythrocytes are diminished in number (oligocythæmia), irregular in size (anisocytosis), small in size (microcytosis), deficient in hæmoglobin content (hypochromalia), and with low colour index, *i.e.* below 0·9, the anæmia almost certainly belongs to Group 1, and in hæmological language may be described as a hypochromic microcytic anæmia.

If on the other hand the number of red cells is below normal, and there is anisocytosis with a tendency to large size (macrocytosis), and especially if there is excess of megaloblasts, and a relatively high colour index, *i.e.* over 0·9, the anæmia must be assigned to the 2nd Group, and may be described as a hyperchromic megalocytic anæmia.

By means of these hæmological distinctions it is possible quite apart from the clinical history to assign any particular type of anæmia to its appropriate group, and at the same time to treat it both prophylactically and remedially on rational lines. It must however be remembered that in the case of infants and young children, the blood as a whole, and particularly its red

cells, does not conform exactly to adult standards, and due allowance must be made for these particular idiosyncrasies. For instance, the blood of the new-born baby has normally a relative excess of red cells (polycythæmia), sometimes amounting to 7 million erythrocytes per c.mm. as compared with 5 millions, the normal for adults, and that from the 3rd or 4th day of life to the end of the 2nd year, both the number of the erythrocytes and the hæmoglobin content falls well below the normal standard.

Again, during the early days of life there is normally an excess of immature cells of the megaloblastic hæmoplastic and reticulocytic type, so that during this period of life the presence of such cells has not the same significance as it has at a later age. The presence of reticulocytes at any period of life suggests undue activity of the blood-forming centres consequent on excessive demands or excessive stimulation.

The Anæmias

Anæmias due to Diminished Red Blood Cell Formation

In this group must be included three forms of anæmia (1) that due to depression of the erythropoietic (red cell forming) tissues by toxæmias, cachexias, etc., (2) that due to disturbances of normal erythropoiesis, as a result of lack of formative material (the latter class of anæmias are called anhæmopoietic), and (3) that due to cessation of function (aplasia) of the erythropoietic tissues.

(1) Anæmias due to Erythropoietic Disturbances.

This disturbance of function is usually caused by infection, such as that associated with rheumatism, rheumatoid arthritis, typhoid fever, and the late stages of tuberculosis. The disturbance is also caused by toxæmias (rare in children) such as nephritis, or lead poisoning. It is also sometimes caused by malignant disease giving rise to cachexia, hæmorrhage, or mechanical interference with the blood-forming centres by secondary growths, leukæmia, Hodgkin's disease, etc.

Treatment. Since all these anæmias are symptomatic, the underlying cause must receive first consideration.

Prophylactic. Preventive treatment consists in the prevention of the underlying cause.

Curative. This consists in the treatment of the primary disease, in general hygienic management, and in the specific treatment with iron (citrate of iron and ammonium 3–5 grains, three times a day), and with liver extract in the form of Campolon (Bayer) injected intra-muscularly to the extent of 5–10 minims,

daily, or in " Depot " dosage of one injection of 1 drachm. In severe cases a blood transfusion may be given at the commencement of treatment.

(2) Anæmias due to lack of Blood-forming Materials (anhæmopoietic), such as Iron and Liver principal.

Anæmias of this type constitute much the largest proportion of all the anæmias met with in infancy and childhood. They are generally known as the " nutritional anæmias," and represent the common form met with in twins, premature infants, and in almost all infants who are exclusively milk-fed without supplementary iron. They are also met with in scurvy, probably owing to lack of vitamin C ; in cretinism owing to lack of thyroidin, and in cœliac disease owing to defective absorption. These anæmias are hypochromic, and microcytic.

Treatment. *Prophylactic.* The most important factor in the prevention of these anæmias is the sound hygienic management of the mother during pregnancy, and of the infant after birth. As regards details, feeding on a diet which contains a sufficiency or iron is the most important.

Curative. These anæmias are as a rule rapidly cured by sufficiently large doses of citrate of iron and ammonium ; from 1 to 3 grains may be given three times in the 24 hours.

Owing to the fact that minute quantities of copper facilitate and promote the synthesis of hæmoglobin, it is rational in the case of nutritional anæmias to give small doses of the metal. Although copper in minute quantities generally exists in combination with iron as an impurity, it is not safe to rely on this contamination, it is better to give it in some supplementary form, such as Crookes' Ferro-Cuprum with vitamin D in Extract of Yeast (F.C.V.D.) ½ drachm three times daily, or in the form of ferrous sulphate tablets (G. L.), one daily.

In the treatment of these nutritional anæmias in infants and children, it is just as well to give increased quantities of vitamin C in the form of Redoxon (50 mg. daily), and vitamin B in the form of Yestamin tablets (gr. 15 once daily). The thyroid hormone should also be given in small amount in the form of Thyroideum Siccum (gr. ¼ once daily). In these cases it is very seldom necessary to resort to blood transfusions, but in those which are very severe or obstinate a single transfusion may give the treatment a good start.

Anæmias due to Lack of Liver Principal.

These anæmias in contradistinction to the " Iron Deficiency Anæmias " are hyperchromic and macrocytic. In their pure

form they are seldom met with, but are more often found in combination with the " Iron Deficiency Anæmias," in which case the blood picture is a composite one and often confusing.

Treatment. *Prophylactic.* None.

Curative. The curative treatment consists in the giving of a sufficiency of liver extract, which may be given in the oral form of Hepatex (Evans) 1 drachm three times a day by mouth; or liver extract (Lederle) 1 drachm, Neo-Hepatex (Evans), or Campolon (Bayer) 10 minims, given intra-muscularly daily. In the case of combined iron and liver deficiency anæmias, the two treatments specific for each must be given simultaneously.

(3) The Aplastic Anæmias.

In a sense all the anæmias due to diminished red blood cell formation come within the category of aplastic anæmias, but as a rule this term is reserved for those anæmias which are due to cessation of function of the erythropoietic tissues, that is to say, in which there is a slowing down or complete cessation of red cell formation. The hæmoglobin content of the blood drops steadily, but the colour index is unchanged. There is no sign of bone-marrow reaction, that is to say, there are no normoblasts or reticulocytes in the blood, and there are no signs of hæmolysis.

There are two forms of aplastic anæmia, one of which is idiopathic, that is to say, no cause for the condition can be discovered, and the other is symptomatic, and due to some toxæmia, such as benzol poisoning, overdosing with salvarsan, X-rays, or radium.

The prognosis in most cases of aplastic anæmia is hopeless.

Treatment. Since pernicious and other severe forms of anæmia may if they remain untreated, finally result in an aplastic anæmia from exhaustion of the blood-forming centres, prophylaxis obviously depends on the early treatment of all forms of anæmia.

Curative. This is most unsatisfactory, unless the underlying cause can be discovered and removed. In the idiopathic cases the only chance of prolonging life is by repeated blood transfusions. As long as these are continued in sufficient amount and given sufficiently often, life may be temporarily prolonged, but as a rule some intercurrent infection ends the scene at a comparatively early date.

ANÆMIAS DUE TO HÆMORRHAGE

These forms of anæmia are not uncommon in new-born babies, from trauma or hæmorrhagic disease. An account of their

treatment will be found in the section which deals with diseases of the new-born (page 153).

Anæmias due to Hæmolysis.

Most hæmolytic anæmias in infants and young children have certain characteristics in common. There is some degree of jaundice, latent or patent, owing to the presence of bilirubin in the plasma. The urine contains urobilin, but not bilirubin. The spleen, and often the liver are enlarged, and both contain free iron. The hæmoglobin content is usually normal, but may be either high or low on occasions. Reticulocytes and normoblasts are usually present in large numbers. Hæmolytic anæmias may be due to congenital abnormalities of the red cells, or they may be acquired owing to infections, poisons, incompatible blood transfusions, and paroxysmal hæmoglobinuria, etc.

Anæmias due to Congenital Abnormalities of the Red Cells

Acholuric Jaundice. In this familial disease the anæmia is of the hyperchromic and microcytic type. The colour index is high, and there is no reticulocytosis. The red cells are abnormally fragile.

Treatment. In mild cases no treatment is required. If many crises occur, splenectomy should be performed.

Icterus Gravis, of the New-born. In icterus gravis, which has already been described (page 135), there is usually a concomitant or subsequent severe anæmia, which yields readily to treatment by blood transfusion (page 711).

Sickle-cell Anæmia. This latter form of familial anæmia is almost entirely confined to negroes. The red cells are sickle-shaped and a reticulocytosis up to 25 per cent is usually present.

Acquired Hæmolytic Anæmias.

The form of anæmia which was formerly known as von Jaksch's syndrome, or von Jaksch's anæmia, is the best-known instance of this variety of anæmia. In it the blood count is almost identical with that of pernicious anæmia of adults, that is to say, there is poikilocytosis and polychromasia. There are nucleated red cells usually of the normoblastic type, the hæmoglobin is reduced to 40 per cent or less, the colour index is low, and the red corpuscles are generally below 2,500,000. There is also usually a leucocytosis. Although this disease has superficial resemblances to leukæmia, it is distinguished from it by its hopeful prognosis.

Treatment. There is no special form of treatment which has any specific action, but with careful general treatment the child generally recovers. Transfusion should not be attempted, as it

has been followed by fatal hæmorrhagic crises. Splenectomy has been found occasionally to be successful. Liver extract may be administered parenterally, and iron treatment should also be tried. Intestinal antiseptics are sometimes of use.

The treatment for other forms of acquired hæmolytic anæmias will depend on the underlying cause, and must be dealt with accordingly.

ABNORMALITIES IN THE WHITE BLOOD CORPUSCLES

Within the limits of health the white cells show quite considerable variations as regards number and cytological characteristics at different ages, but diagnosis is often assisted by reference to the leucocyte picture, if the question of age is taken into the consideration.

Total Number of Leucocytes at Different Ages. Under normal conditions the total number of white cells in the blood is as follows :

New-born infants . . .	16,000 to 29,000 per c.mm.
5th day of life	12,000 per c.mm.
1st week to 12th month . .	6,000 to 12,000 per c.mm.
5 years	5,000 to 10,000 per c.mm.

In abnormal conditions these limits may be exceeded (leucocytosis), or reduced (leucopenia).

Leucocytosis

An increased number of white cells occurs in all pyogenic infections, such as in abscesses, appendicitis, peritonitis and empyema, also in jaundice, leukæmia, and in whooping-cough.

Treatment. The treatment consists in the discovery of the cause and its specific therapeusis.

Leocopenia

This generally occurs in influenza, malaria, measles, typhoid, para-typhoid, and occasionally in agranulocytosis (agranulocytic angina), splenic anæmia, brucella infections (undulant fever), burns, etc.

Treatment. Apart from the specific treatment of the underlying cause, the indication is to make full provision for supplies of nuclein in the form of yeast preparations, Marmite, Bemax, Nucleic acid, or as nuclein itself (gr. x, three times a day).

Variations in the Differential Leucocyte Count

Polymorphonuclear Count. The normal count is as follows:

	Per cent.
1st day of life	70
5th ,, ,, ,, about	34–40
1st week to 6 months	19–37
6 months to 2 years	25–30
5 years	48–62

The count is reduced in influenza, typhoid, para-typhoid, occasionally in agranulocytosis, and undulant fever, and it is increased in most acute affections, abscesses, bacteræmia, pneumonia, etc.

Small Lymphocytic Count. The normal count is as follows:

	Per cent.
1st day	15
5th day to 2 years	45–54
5 years	18–21

The count is increased in lymphocytosis, in lymphatic leukæmia, mumps and whooping-cough, and occasionally in glandular fever.

Large Lymphocytic Count. The normal count is as follows:

	Per cent.
1st day of life	39
5th day to 2 years	56–66
5 years	35–37

The count is increased and decreased as in the case of small lymphocytes.

Eosinophiles. The normal count is as follows:

	Per cent.
1st day of life	0·8–3·5
5th ,, ,, ,,	0·3–0·25
1 to 4 weeks	0·2–0·6
2 months to 2 years	1·5
5 years	1·4

The count is increased in allergic conditions and in intestinal parasitism.

Leukæmia

Although attempts have been made from time to time by various authorities to classify the different types of leukæmia which are met with in infants and children, according to the differential count of the leucocytes, opinion is definitely inclining to the view that the leukæmias are essentially diseases of the whole of the hæmopoietic system, in which the spleen, liver,

lymphatic glands, and bone-marrow are conjointly involved, but in varying degrees, and with corresponding blood picture. It is also now generally believed that leukæmia, chloroma, and sarcoma, represent different phases of one and the same malignant process, but varying in degree and in intensity. Whether this is so or not does not affect either the treatment or the prognosis, for all are practically hopeless conditions in children.

Treatment. Although the chronic forms of leukæmia which are met with in older children and in adults are sometimes temporarily benefited by X-rays, radium, benzol or arsenic, the acute forms which are the only ones which occur in infants and young children, are entirely refractory to these methods of therapeusis, but temporary benefit is occasionally derived from blood transfusions, and the exhibition of malt extracts and large doses of vitamins.

ABNORMALITIES IN THE BLOOD PLATELETS

Blood platelets or thrombocytes are small non-nucleated bodies normally found in the blood to the extent of 250,000 to 400,000 per c.mm. They are supposed to be concerned in the process of blood coagulation, and show diminished numbers in certain hæmorrhagic diseases in which this process is delayed or abnormally conducted, as for instance, in purpura hæmorrhagica, chronic infections, leukæmia, etc. Their number is occasionally increased in some grave forms of anæmia, and in Gaucher's splenomegaly.

Thrombopenia

In this condition the number of blood platelets may be reduced to 10,000 or even less.

Treatment. Temporary increase in the number of thrombocytes follows injection of adrenalin, and also blood transfusions. Otherwise there is no known treatment, except that described in the following paragraph.

Purpura

Although purpura, or a tendency to spontaneous extravasations of blood into or beneath the skin and mucous membrane is included here among blood abnormalities, in the great majority of cases it is clearly secondary to some pre-existing disease, mostly of a chronic infective character, such as the exanthemata (hæmorrhagic varieties), cerebrospinal meningitis, rheumatism, etc. It occa-

sionally occurs however, apart from any infective process, as in chronic nephritis, acute scorbutic, leukæmic, toxic, nervous, or allergic conditions. There still remains however quite a large number of varieties of purpura for which no such explanatory cause, or indeed any cause can be discovered, and for this reason they have been classified among the ever-dwindling number of so-called idiopathic diseases. Quite possibly within the near future cases of purpura for which at present no cause can be discovered, may be traced to some filter-passing virus. The fact that purpura is seldom found in children under 1 year of age, unless in the so-called hæmorrhagic diathesis of the new-born, makes it all the more probable that so-called idiopathic purpura is an acquired disease, and if acquired, probably infective in character.

It is doubtful whether the usual classification of purpura into four distinctive varieties, namely, purpura simplex, purpura hæmorrhagica, purpura athritica (rheumatic), and Henoch's purpura, is justifiable. It is more probable that they are all one disease, but show somewhat different characteristics as regards the number of platelets, coagulation, and bleeding-time, etc. But however much the symptoms may differ with respect to those details in different cases, there is one pathological feature which appears common to all, namely, a definite decrease in the number of platelets.

Treatment. The whole subject of the treatment of purpura has recently undergone revolutionary changes, owing to the success which in certain cases has attended the operation of splenectomy. The class of case which benefits from this treatment is the one which in accordance with present conceptions is described as idiopathic, which is chronic, recurrent, and serious, and does not respond to the ordinary treatment of blood transfusion. Cases of purpura which are clearly traceable to some underlying cause are not suitable for such drastic treatment, and must be treated on lines which are directed to the cause.

In idiopathic cases as well as in some which are clearly traceable to an underlying cause, the treatment at first resolves itself into that of repeated blood or serum transfusions (intravenous and not intraperitoneal).

In still milder cases, rest in bed with appropriate diet and the administration of iron may be all that is required in the way of treatment. Injections of adrenalin sometimes give temporary relief, but X-ray therapy of the spleen or of bone medulla does not in my experience give good results, but cases of the so-called Henoch's purpura type, have appeared to me to improve

when treated on the assumption that intestinal toxæmia plays some predisposing part in the etiology. I have found, for instance, that the limitation of proteolysis in the bowel by the prolonged administration of sour milk fermented by lactic acid organisms combined with a limited protein intake, and the administration of digestive adjuvants such as Liquor Pancreaticus, has been followed with definite benefit. Bone-marrow preparations have also been recommended, but I have not found them of value excepting as a help in the cure of any post-hæmorrhagic anæmia which may exist.

The order in which these remedies should be tried is as follows : rest in bed ; good dietary with plenty of vitamins, such as Adexolin, and yeast tablets, also mineral salts (mixed salts gr. xv, three times a day, see page 696).

If this simple form of treatment does not succeed, a course of iron and arsenic should be tried, and may be given in the form of citrate of iron and ammonium gr. v, three times a day, with Liquor Arsenicalis minims 2, three times a day.

If these procedures meet with no better success, intravenous blood transfusions to the extent of 100 c.c. every 3rd or 4th day may be tried. If the individual attacks clear up under this treatment, but recur with sufficient frequency to give anxiety, treatment directed to secure intestinal antisepsis by means of sour milk, Kerol, or other means described on page 695, may be resorted to in the periods between the attacks.

If none of these expedients control the attacks, and the latter recur at frequent intervals, the question of splenectomy should be seriously considered. There is however no need to despair of ultimate recovery without resort to this drastic step if sufficient patience is exercised. I had one case which lasted for 19 years, and then ultimately cleared up. The individual attacks were not treated with blood transfusions, but by hæmolytic horse serum, and the general lines indicated on page 223, for intestinal intoxication.

Hæmophilia

Hæmophilia is a constitutional and familial disease, confined to males, but transmitted in the female line, conforming to Mendelian laws of inheritance, and recessive in character. In hæmophilia the coagulation time is prolonged from the normal (2 to 6 minutes) up to 60 minutes or more. The " bleeding time," namely, the period for which blood continues to flow from a small skin puncture is not prolonged beyond the normal 3 minutes. Hæmorrhage usually follows trauma of any kind, but it may

occur apparently as a spontaneous symptom preceded by certain definite prodromata, of which the more usual are giddiness, palpitation, sweating, and dyspnœa. The bleeding is persistent rather than severe, and may occur in almost any situation, but it most frequently takes the form of epistaxis or hæmorrhage into joints. It also occurs occasionally from the stomach, intestines, urethra, or kidneys. Muscular hæmorrhages and extravasations into serous cavities are rare.

The cause of the bleeding is apparently due to some defect in the make up or composition of the platelets, rather than to a deficiency in numbers, a defect which interferes with the formation of prothrombin or thrombin, and thus delays coagulation. An additional factor may be some abnormal permeability of the walls of the capillaries and small blood-vessels.

Treatment. *Prophylactic.* Eugenic methods should be employed with the object of limiting or controlling the birth of children in hæmophilic families. Male members of such families should if possible reside in warm countries and avoid operations such as extraction of teeth, circumcision, etc., unless precautionary measures such as those described under Curative Treatment have been taken.

Curative.

The Acute Attack. The most reliable expedient is the " arm to arm " intravenous transfusion of female blood of the correct grouping, 100 to 200 c.c. is not too large a quantity for one operation. The indirect intravenous transfusion of defibrinated or citrated blood is less certain, but all the same efficacious. The intra-muscular injection of 30 to 50 c.c. of whole female blood is still less effective, but is more easily carried out. The value of animal sera, hæmolytic or otherwise, or the use of calcium, ergot, parathyroid extract, or œstrogenic substances, is not advised, since resort to such lines of treatment involves delay in the application of the only sure and certain means, namely, that of blood transfusion. None of these methods, or any other which has so far been tried, including protein shock, has any permanent effect on the hæmophilic diathesis.

Control of Local Hæmorrhage. Hæmorrhage in accessible parts can be controlled by long-continued pressure applied by hand, tourniquet, or packing with superimposed layers of sterile gauze soaked in fresh blood, serum, tannic acid, or solution of adrenalin (1 in 1000).

Treatment by Viper Venom. For the purpose of controlling accessible hæmorrhages, two different viper venoms, namely,

Russell's [1] and Moccasin [2] snake poison have been employed. The latter venom has been extensively employed at St. Bartholomew's Hospital, as a local hæmostatic, and it is claimed that it has a definite influence on the permeability of the capillary wall. I have no personal experience of its use.

Epistaxis

Epistaxis is very common in childhood—rare in infancy. Local causes are trauma, polypi, foreign bodies, ulceration of the septum, picking of the nose, angioma of septum, fibroma, sarcoma, acute rhinitis, sinusitis, and hay fever. The general or constitutional causes are any of the hæmorrhagic diatheses, such as hæmophilia, purpura or leukæmia; rheumatism, heart disease and nephritis are also causes. Epistaxis is also a prodroma of acute infections, such as typhoid and influenza (see also page 668).

The common form of epistaxis in children is that which for want of a better appreciation of the underlying etiology is called "spontaneous," that is to say, without any obvious cause. Bleeding usually takes place from the so-called Kiessalbachs area, which is situated in the anterior part of the nasal septum. This is a highly vascular spot, liable to ulceration and to bleeding when the scabs are picked off. Bleeding from this or other areas also occurs from a general congestion of the nose, such as that which accompanies the commencement of a cold, or other acute infection. The bleeding relieves the congestion and is usually beneficial rather than harmful, although at times it may cause a good deal of alarm.

Treatment. *Prophylactic.* Prophylaxis consists in the treatment of any area of ulceration on the septum, the prevention of picking, and attention to other underlying conditions.

Curative. The child must be reassured, and kept in an upright position. If the bleeding is from the septum, the nose should be pinched and the pressure kept up for some ten minutes. This treatment is often effective, especially if a little cotton-wool impregnated with Coagulen-Ciba, Hæmoplastin (P. D. & Co.), or Suprarenin (Bayer) is applied.

If bleeding is very intractable, a hypodermic injection of 2 c.c. of Hæmoplastin may be given, or the nares plugged with gauze from behind forwards. After plugging, care should be taken to

[1] "Russell's Viper Venom"—Macfarlane, R. G., and Barnett, B., *Lancet*, 1934, *ii*, 985.

[2] "Moccasin Snake Venom"—Peck, S. M., and Rosenthal, N., *Jour. Amer. Med. Assoc.*, 1935, *civ.* March 30th, p. 1066.

see that the bleeding has been completely controlled, and that blood does not escape into the naso-pharynx, and enter the stomach.

ABNORMALITIES OF THE BLOOD PLASMA

Acidosis

There are few subjects in the whole domain of medicine about which so many misconceptions have arisen as that of acidosis. More children are thought to be suffering from this condition than from all other childish complaints in combination. Every " sick headache," every attack of biliousness, every evidence of neurasthenia, myasthenia, or nervousness, is nowadays ascribed to acidosis, and treated with glucose and bicarbonate of soda. Although the presence of acetone in the breath or in the urine is almost invariably described as " acidosis " nevertheless this symptom can and does exist not infrequently without any accompanying acidosis at all, while on the other hand acidosis itself, especially in the case of infants and young children, frequently exists in high degree without revealing itself by acetonuria or any of the other symptoms which are commonly thought to be pathognomonic of this condition.

Acidosis has been defined as a condition in which the reaction of the blood is less alkaline than normal, but even this definition is not entirely satisfactory, as the reaction of the blood, that is to say, its hydrogen ion concentration, practically never varies except *in extremis*. Indeed, as the late Professor McKim Marriott said in his book on Infant Nutrition, if the reaction of the blood becomes as acid as distilled water, or as alkaline as ordinary tap water, such a condition is incompatible with the continuance of life.

The term " Acidosis " should really be reserved for a condition in which the acidity of the body as a whole, rather than the blood, becomes less alkaline than normal. The reaction of the plasma is maintained at a normal constant by a number of very delicate mechanisms, and it is when these mechanisms are unduly exercised or strained in maintaining this constant, that the symptoms which we commonly recognize as acidosis are produced. In fact the symptoms of acidosis are not due to an acid condition of the blood, but to the calling into play under adverse circumstances of a variety of mechanisms which prevent it from becoming so.

One of the most important of the symptoms by which we

recognize acidosis is hyperpnœa or air-hunger, a symptom which is produced by the calling into play of one of those mechanisms, namely, that which effects the removal of carbonic acid gas from the blood, through the intermediation of the respiratory centre. If there is any tendency for the blood to lose alkalinity by the presence in it of excess of carbonic acid gas (gaseous acidosis), the respiratory centre becomes more active, and the carbonic acid gas is got rid of at the lung surface by more rapid and deeper respirations. Hyperpnœa owing to this cause is rapid, deep and regular, and therefore quite different from the hyperpnœa of pneumonia, which is shallow and rapid, and from the irregular respirations of the Cheyne-Stokes or Biot types.

The practised observer is often able to recognize acidosis in young children either by the presence of hyperpnœa or the ready development of dyspnœic symptoms on very slight exertion. A useful method of estimating the degree of acidosis is founded on this observation. It consists in ascertaining how long the child can hold his breath without taking a respiration when the mouth is closed and the nose pinched. If under these conditions the breath cannot be held for more than 30 seconds, it is good evidence of acidosis, but unfortunately the test cannot be applied in the case of infants or very young children.

The second mechanism by which the reaction of the blood is maintained at a definite constant is by the neutralization of such acid radicles in the blood as phosphoric acid, sulphuric acid, lactic acid, acetic acid, oxalic acid, uric acid, etc., by means of the buffering action of the bicarbonate of soda present in the blood plasma. Evidence of this mechanism being called into play is to be found in the presence of an excess of salts in the urine, formed by a combination of the sodium base with the acid radicle, a process which results in the raising of the specific gravity of the urine, and in a reduction of the amount of the bicarbonate reserve present in the blood plasma, which can be estimated by Van Slyke's method. If the carbon-dioxide combining power of the plasma falls below 43 vols. per cent as compared to the normal 50–70 per cent it is regarded as evidence of some degree of acidosis. In cases of extreme acidosis the combining power may fall as low as 20 vols. per cent.

The third method of maintaining the reaction of the blood is the buffering capacity of the plasma phosphates. By the conversion of neutral into acid phosphates a considerable quantity of soda or other base may be set free for the neutralization of acid radicles, and the neutral salts together with the acid phosphates thus produced are excreted by the kidneys. In conditions of acidosis

much phosphorus is thus lost to the system and appears in the urine, producing a condition of phosphaturia.

The fourth method is the formation of free ammonia out of urea in the kidneys. This free ammonia can be used for the neutralization of acid bodies, and an almost inexhaustible amount of this base can be provided by this means. The resulting ammonium salts are excreted by the kidneys, and are found in the urine. The quantity of ammonium salts excreted during the 24 hours as estimated by laboratory methods gives a measure of the degree of acidosis, but the presence of excess of ammonium salts may be suspected if the urine has an ammoniacal odour on exposure to the air. In the case of young babies wearing napkins this excess is demonstrated by the smell of ammonia which arises as soon as the napkins are undone or taken off, as also by excoriation of the buttocks due to irritation by the ammonia pent up under the cloth. This rash, which takes the exact shape of the napkin, is known as " Napkin Rash."

In a rough-and-ready way the degree of acidosis may be estimated by the amount of sodium bicarbonate that is required to be given by the mouth to render the urine alkaline, and to stop the excretion of ammonium salts in the urine (Sellard's test). If the administration of 5 gm. of sodium bicarbonate renders the urine alkaline, it may be assumed that an acidosis does not exist, but the more bicarbonate beyond this amount required to effect the neutralization the greater the degree of acidosis.

Another method by which the acid radicles may be eliminated from the body, and the acid-base equilibrium thus restored, is the excretion of certain organic acids in the free state by the kidneys. Such acids are occasionally found in the urine, but their quantity is difficult to estimate, and their identity difficult to determine.

Another method is by the elimination of free hydrochloric acid by vomiting, and a further one is the elimination of acid in the fæces.

A condition of acidosis may therefore be evidenced by any of the following symptoms, or any combination of them :

1. Hyperpnœa (deep, regular and rapid breathing).
2. Reduction in the alkaline reserve of the blood (Van Slyke's Test.)
3. An increase of acid phosphates in the urine (Phosphaturia).
4. An excess of ammonium salts in the urine (Napkin Rash).
5. A high degree of acidity of the urine, due to free acid or acid phosphates, which requires for its compensation the taking of large doses of bicarbonate of soda by the mouth.
6. By a reduction in the time the breath can be held.

It will be noticed that neither a ketosis nor vomiting are included in this list of the symptoms of acidosis, although popularly both are supposed to be characteristic of the condition. Vomiting often occurs as a concomitant of acidosis, but when it does, it is usually due to the underlying cause of the acidosis, and not to the acidosis itself. Acetone may or may not be present in the urine or in the breath, if it is, it is due to a concomitant ketosis.

Among the underlying causes of acidosis the following are the most common :

1. Over-production of acid from faulty dietary. In practical therapeutics it is now generally recognized that some foods produce more acid in the body than others, and that some diets tend to produce a condition of alkalinity. An unbalanced meat or protein diet produces excess of acid radicles owing to the formation of sulphuric and phosphoric acid on combustion in the body, whilst fruits and vegetables supply a considerable amount of base. Such foods as sugar, fats, and most cereals, contain very little base. In faulty diets containing elements which produce much acid and supply little base, acidosis is likely to arise in the body of the individual who consumes them.

2. A second cause of acidosis is the defective metabolism of fat, as in diabetic states, and in most cases of cyclic vomiting.

3. Further causes are infection, and toxæmic conditions.

4. Another cause is from failure of renal function, as in nephritis. In both acute and chronic forms of this disease sulphates and phosphates are retained in the blood, and the alkaline reserve is lowered.

5. Acidosis can also result from diarrhœa, owing to loss of base by the bowel, and by the dehydration of the tissues to which it disposes.

6. Acidosis can arise from the taking of drugs, as for instance, inorganic acids, such as hydrochloric, also ammonium chloride, and the salicylates.

It is essential that the various causes of acidosis should be taken into account before devising any particular line of treatment. I have designed a diagrammatic schema to indicate most of the possible sources of acid which go to swell the sum total in the body. To this diagram (Fig. 20) the reader is referred.

Treatment. *Prophylactic.* The preventive treatment of acidosis consists in avoiding all the etiological factors which give rise to the many underlying or parent conditions. These factors include unhygienic conditions, want of sun, want of air, and want of other stimulants to metabolism ; endocrine and deficiency diseases, diarrhœa and nephritis (see Fig. 20).

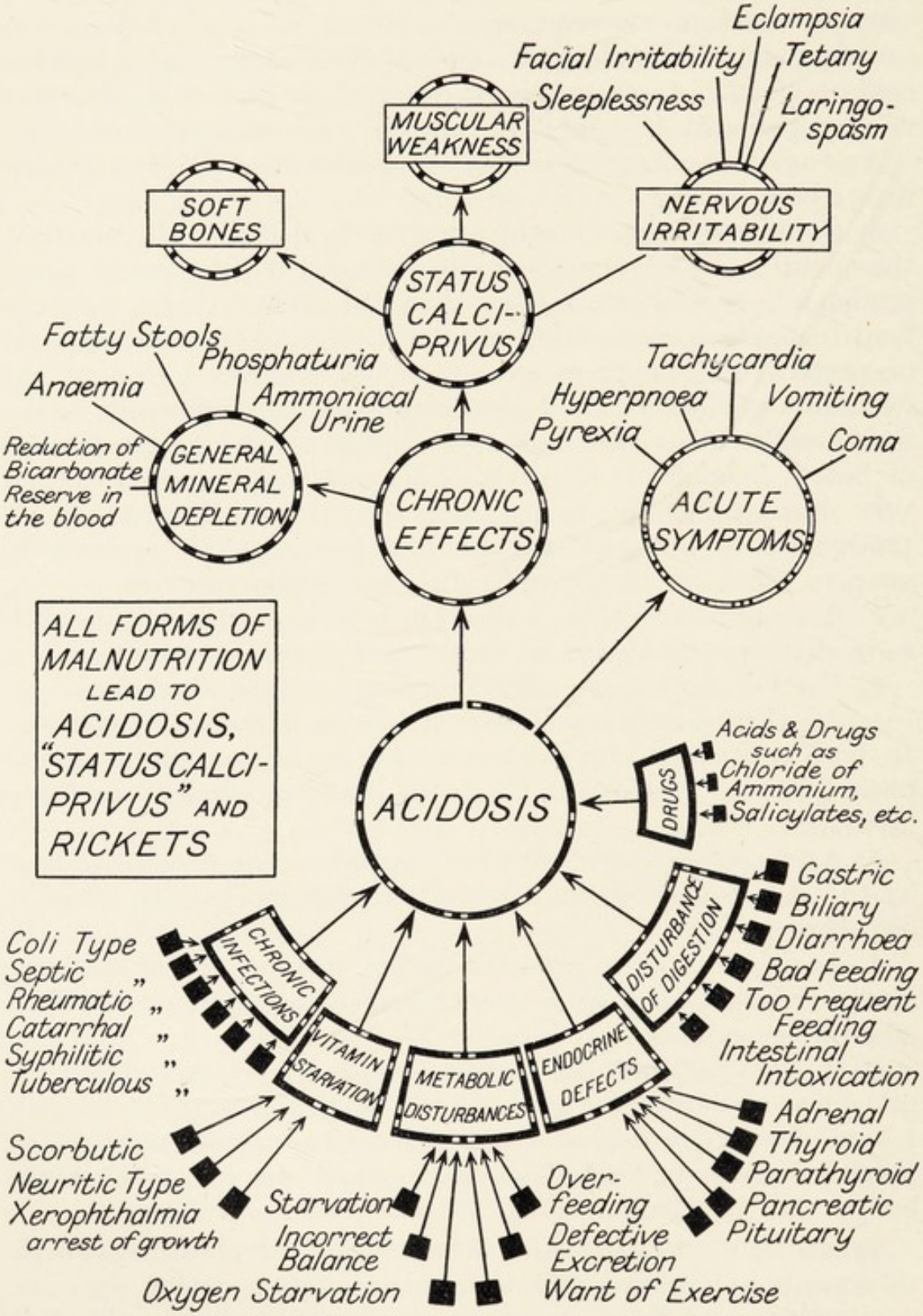


FIG. 20.—Showing the contributory sources of acid to the total pool in Acidosis and the acute and chronic effects.

In addition to these, nervous and psychological disturbances are also at times responsible for inducing a condition of acidosis. Teething in children between 6 months and $2\frac{1}{2}$ years is a frequent cause.

Curative. The successful treatment of acidosis depends upon a correct diagnosis of the underlying cause, that is to say, upon its particular type. Thus acidosis due to faulty dieting requires attention in the food : that due to infections requires the specific treatment of the parent disease. Acidosis due to avitaminoses must be treated by the supply of the defaulting vitamins : that due to endocrine disturbance, such as athyroidism, must receive the appropriate internal secretion. The acidosis of renal disease must have the treatment appropriate to the major condition.

It is impossible to give a separate account for the treatment of these different varieties of acidosis, but it may be useful to select one or two of the more common types.

Acetone Type. This variety, though possibly not the most frequent, is the one most often diagnosed, owing to the presence of the tell-tale acetone in the breath or urine. It may be a symptom of actual diabetes, and if so must be treated on the lines appropriate to this condition. It is rare in children under 5 years of age. On the other hand, it may be one of the symptoms of cyclic vomiting, which is described later (page 322). More generally, however, the acetone type of acidosis is due to defective metabolism of fat, and is associated with some disturbance of the glycogenic function of the liver, but it is not of the same serious nature as the acidosis of either diabetes or cyclic vomiting. It is not safe however to make a diagnosis of acidosis simply from the presence of acetone in the breath, for as already stated, such a condition may exist in the presence of an alkalosis. But in all cases of demonstrated ketosis, the possibility of an accompanying acidosis must be taken into account, and if found, treated appropriately.

The rational treatment of acidosis of this type is to reduce the intake of fat and to increase the carbohydrate allowance. Prophylactic measures against the acidosis by the routine administration of bicarbonate of soda, or better still of mixed salts (see page 696) is desirable.

Dietetic Type of Acidosis. The dietetic type of acidosis is in all probability much the commonest variety, but it is seldom diagnosed, unless it is accompanied by definite crises such as occur in cyclic vomiting. It is met with in badly fed and more particularly over-fed children. The reduction of the alkaline reserve,

and indeed the general mineral depletion of the tissues, is due to the neutralization of fatty and other organic acids of large molecular size, produced in excess owing to failure of oxidation and metabolic processes. This neutralization, which is of course obligatory, entails the using up of the alkaline reserves, and unless these reserves are compensated for by independent administration of bicarbonate of soda or other sources of base, the reduction will soon reach dangerous proportions. The condition is aggravated by a diet which leaves an acid ash, or one which does not contain a sufficiency of base. It is more particularly found in children who are fed on an excess of protein, sugar, and cereals, or on a diet which is deficient in base-containing elements.

The treatment is to supply a properly balanced dietary, and until acid-base equilibrium is restored to supply bicarbonate of soda or nutritive salts (page 696) independently. These cases are seldom complicated by ketosis, and therefore the acidosis is liable to remain undetected, but in babies the co-existence of "Napkin Rash" with urine smelling strongly of ammonia, helps the diagnosis.

Cyclic Vomiting. This condition requires special consideration. Possibly it should not be included in the list of acidoses, but should more appropriately be described as a particular form of ketosis, or as a nervous disturbance. As a rule each attack of cyclic vomiting is accompanied by the pathognomic evidence of a ketosis, although between the attacks there may be no symptoms due to this condition. The vomiting is not due to an accompanying acidosis, for it may occur in cases in which there is a definite alkalosis. Although in the majority of cases there actually is an acidosis, emesis is more probably due to the stimulation of the vomiting centre by some toxic substance, which has not been rendered inert owing to failure of liver function, than to the acidosis itself.

Cyclic vomiting seldom occurs in children under 2 years of age, but it is comparatively common in those over 3 who are of nervous type or liable to allergic manifestations. Subjects of these attacks can generally be cured by dieting alone. In my experience the most important indication is to prevent intestinal intoxication by strict regulation of protein foods, such as meat, fish, eggs, or even milk. The diet should consist mainly of cereals, fruit, and vegetables. Fats should be limited, but by no means excluded. In addition, the regular taking of small doses of Petroleum Emulsion to prevent intestinal decomposition has a favourable influence. Nutritive salts (page 696) to supply base, and correct any tendency to acidosis, should be given regularly.

One triturette of 15 grains daily is probably sufficient for this purpose.

For the attack itself, which is generally self-limiting by reason of the enforced starvation to which the vomiting disposes, the main indication is to compensate for the loss of water sustained through the vomiting. Water may be given by the mouth if it can be retained, but otherwise by enema, or subcutaneous injection. If water can be retained by the stomach a small quantity of glucose may be added, and also some bicarbonate of soda, but they are not always necessary.

Acidosis of the Dehydration Type, including Diarrhœa.

In these forms large quantities of water are required to compensate for the desiccation of the tissues caused by the diarrhœa or vomiting. This is necessary to provide for the elimination by the kidneys of the salts which result from the neutralization of the acid radicles. The water may be given by the mouth if it can be retained, otherwise by intravenous or subcutaneous injections. In babies under 1 year of age the dehydration in diarrhœa is often severe, and if not compensated for may have fatal results. If the acidosis is of a serious type, bicarbonate of soda or Hartmann's solution (page 717), can be added to the water.

Acidosis of Renal Type.

Acidosis is one of the manifestations of kidney insufficiency, nephritis, or nephrosis. The condition does not require any special line of treatment apart from the underlying cause. Calcium lactate however may be given in large doses up to 10 grains three times a day to make good the calcium shortage in the blood, which generally complicates the condition. Sodium bicarbonate is seldom required and may prove dangerous, owing to the fact that it may lead to further calcium depletion by substitution, and thus lead to a condition of tetany.

The Use of Bicarbonate of Soda. Bicarbonate therapeusis should not be indiscriminately used in all cases supposed to be acidosis, for it may be actually dangerous unless there is a clear indication of reduction of the alkaline reserve, as proved by direct estimation by means of the Van Slyke method. The amount of bicarbonate necessary to restore the alkaline reserve has been estimated on the theoretical assumption that the blood and tissue fluids contain about 2 gm. of sodium bicarbonate per kilogram of body-weight. If the plasma bicarbonate has been reduced in any case of acidosis by one half, as shown by the Van Slyke test, it is a justifiable assumption that 1 gm. of bicarbonate of soda per kilogram of body-weight will be sufficient to restore equilibrium, and this amount should be given in small and repeated

doses, by the mouth if it can be retained, with plenty of water, or if not, by enema, or intravenous or subcutaneous injection. If given by the intravenous route some care must be taken in the preparation of the solution. The strength should be 4 per cent, and the salt should be added to boiled sterile water, which should not be boiled again after the addition of the bicarbonate of soda, as the latter is gradually converted into the more irritating carbonate by the heat. The solution may, however, be sterilized by boiling, provided that carbon-dioxide is allowed to bubble through the solution to recreate the carbonate into bicarbonate.

Ketosis

The term " Ketosis " signifies a condition in which ketones are present in unduly large quantities in the body. Although there are several varieties of ketone, it is usually assumed that if one ketone, namely acetone, is present in the urine, a condition of ketosis exists. The term does not however necessarily imply that there is any change in the acid-base balance of the blood, but the presence of acetone is evidence of the incomplete combustion of fat, which may be, and often is, accompanied by the presence of other ketogenic bodies, namely, beta-oxy-butyric and aceto-acetic acid. The presence of these acid bodies in excess may disturb the *p*H of the blood, but it should be remembered that acetone itself has no acid properties and cannot have this effect.

The immediate cause of a ketosis is the absence of available sugar to facilitate the combustion of fat. Indeed it has been picturesquely stated that fat burns in a carbohydrate flame. In some way, as yet not understood, the glycogenic function of the liver is concerned in the combustion of fat, a fact which may possibly explain the association of ketosis with failure of liver function, or with nervous disturbances which indirectly affect hepatic metabolism. On the other hand the association of starvation, vomiting, and diabetes, with the failure of fat combustion, is more explicable, inasmuch as all these conditions interfere with the supply of available carbohydrate. Infections also are often accompanied by a ketosis. This may be due to some interference with the normal functions of the liver owing to a general toxæmia.

It is a little difficult to assess the amount of injury which is inflicted on the organism owing to the presence of ketone bodies in the blood. Probably it is very slight, for a ketosis of high degree can be artificially induced in children by a ketogenic diet or other means without any accompanying symptoms of a pathological nature. Symptoms such as pyrexia, vomiting, drowsiness,

and air-hunger, accompanying an acetonæmia or acetonuria, are almost certainly due to some underlying condition such as toxæmia, or a condition of acidosis, and not to the presence of ketones in the body.

Treatment. *Prophylactic.* Preventive treatment consists in the avoidance of the etiological factors which lead to the production of the underlying conditions, such as starvation, vomiting, toxæmia, pyrexia, diabetes, glycosuria, or chloroform anæsthesia.

Curative. The cure also depends on the treatment of the parent disorder, and consists largely in the supply of available carbohydrate material of any kind, but which, under conditions of emergency, is best given in the form of glucose. Complete withholding of food with the exception of sugar and orange-juice will in the great majority of cases effect a cure of acetonuria in 12 to 24 hours. There is no need to supply sodium bicarbonate, on the contrary it is better omitted, unless there happens to be an accompanying acidosis. If the ketosis is secondary to diabetes or glycosuria, the use of insulin is indicated.

Ketogenic Diet. Of recent years the artificial production of a ketosis has been practised as a method of treating both epilepsy and coli infections of the urinary tract (pyuria and bacilluria). As regards epilepsy, it has been known for some time past that a condition of alkalosis is apt to precipitate an attack, and contrariwise, that an acidosis has some inhibitory effect on its development. Use has been made of this knowledge in the prophylactic treatment of the condition, and drugs such as calcium chloride, ammonium chloride, and hydrochloric acid, have been given to individuals suffering from epilepsy, with the object of producing an experimental acidosis, and for the same purpose what has been called a " Ketogenic Diet " has also been used. This method of treatment, together with that of dehydration, will be again referred to in the article on epilepsy (page 562). A ketogenic diet consists of a one-sided diet consisting mainly of fat and protein foods. A typical diet for a child 2 years old is as follows :

Breakfast

8 oz. milk.
Part of an egg.
2 oz. diabetic bread.
½ oz. butter.

Dinner

1–2 oz. meat with plenty of fat
or fat fish such as herring.
1 oz. green vegetables.
2 oz. custard pudding.

Tea
8 oz. milk.
2 oz. diabetic bread.
½ oz. butter.
½ oz. jam or jelly.

While giving such a diet, precautions should be taken to supply vitamin B and vitamin C independently, the former as Bemax or Marmite, and the latter as ascorbic acid (Redoxon—1 tablet daily).

As regards the treatment of pyuria (Coli infection of the urinary tract), or other forms of bacilluria, it has been claimed that the elimination of ketone bodies in the urine has a better bactericidal action than an acidosis produced by acid drugs such as acid phosphates, either with or without the addition of hexamine. I have had some personal experience of the use of a ketogenic diet in both those conditions, but I have seen no better results from this method than I have from the old orthodox methods of treatment, I do not therefore advise it.

Alkalosis

Alkalosis is a more frequent and severe condition than is generally supposed. It occurs when there is any considerable loss of acid from the body, as in cases of persistent vomiting, or when there is an excessive intake of alkali, such as sodium bicarbonate. It may also be the result of hyper-ventilation (gaseous variety) due to emotional disturbances, constant crying, or through the breathing of attenuated air at high altitudes, the latter being instances of so-called gaseous alkalosis.

The clinical symptoms of an alkalosis are first slight headache, dizziness, and mental confusion, and later nausea, prostration, drowsiness, and muscular weakness. These symptoms are not so much due to excess of plasma bicarbonate as to a reduction in the amount of ionized calcium in the blood, which is an almost invariable concomitant, and in this connection it must be noted that the symptoms are not due to want of total calcium in the blood, as to a reduction in the ionized factor. With such a reduction a condition of spasmophilia is produced, which may take the form of tetany, laryngo-spasm, or merely shallow, slow and irregular respiration, the exact antithesis of the breathing in acidosis. There is sometimes in alkalosis an actual change in the hydrogen-ion concentration of the blood, in which the *p*H may be as high as 7·8 as compared with 7·4 the normal, and the CO_2 combining power of the blood plasma as high as 100 vols. per cent.

Treatment. *Prophylactic.* The prevention of alkalosis consists in the avoidance of the major conditions of which it is a symptom. The chief of these are excessive vomiting due to pyloric or intestinal obstruction, or the excessive intake of sodium bicarbonate, sometimes employed to counteract symptoms of a supposed acidosis. High altitude is an occasional cause.

Curative. Apart from the employment of both prophylactic and remedial means directed towards the underlying cause, the actual treatment of alkalosis consists in restoring acid to the body by the administration of hydrochloric acid, which may be given with milk (hydrochloric acid milk). Hydrochloric acid is added to the milk until it has a distinctly sour taste; 5 or 6 minims of the dilute acid (B.P.) given in this way is sufficient for one dose. This may be repeated until the symptoms disappear. The same result may be achieved by giving ammonium chloride. When this is administered, the ammonium is converted into urea, leaving the hydrochloric acid radicle free for the neutralizing of alkalies. The amount to be given should be about 1 gm. (15 grains) in the 24 hours.

Equally efficacious is calcium chloride, which serves a double purpose: it compensates for the calcium depletion, and lowers the *p*H. The calcium base is excreted by the bowel, and the hydrochloric acid radicle is left in the body. As an emergency measure—for instance, in spasmophilic convulsions—the calcium chloride may be given intravenously, but not subcutaneously, owing to its irritating qualities, the quantity to be given being about 5 grains per kilogram of body-weight. It is best injected as a 5 per cent solution.

Tetany

Tetany is usually regarded as one of the manifestations of an alkalosis, and for this reason is included in this section, a course which is justified by the fact that in most cases of tetany there is a definite shifting of the acid-base balance, or *p*H, in the direction of alkalinity, owing to an increase in the plasma bicarbonate. It is questionable however whether the symptoms of tetany are so much due to the excess of bicarbonate, as to a lowering of the ionized calcium blood content which always co-exists with this condition. The amount of ionized calcium may be regarded as about one-third of the total estimated blood calcium, but in certain cases although the total blood calcium may be high or normal, the ionized fraction may be abnormally low.

There are many conditions widely divergent in pathogenesis which may bring about this fall in ionic calcium, as for instance:

1. Removal or loss of function of the parathyroid gland (parathyroid tetany) (see page 363).
2. The usual etiological factors concerned in the production of rickets (ordinary infantile or rachitic tetany).
3. Loss of acid through vomiting (gastric tetany).
4. Loss of CO_2 through hyperventilation (hyperpnœic tetany).
5. Excessive ingestion of alkali (bicarbonate tetany).
6. Retention of phosphates in the blood by nephritis or nephrosis (phosphate tetany).
7. Defective absorption of calcium (cœliac tetany).

Treatment. *Prophylactic.* Preventive measures are the same as those indicated for ordinary cases of alkalosis, already described, or for any of the conditions which conduce to a lowering of the plasma calcium, but it must be clearly understood that the *causa vera* of tetany is in all probability not an excess of blood bicarbonate, but a lowering of the ionic blood calcium, which may be secondary to it. Thus on this hypothesis, prophylactic measures must be understood to include those which are prophylactic in this respect, the most important of them being included among the anti-rachitic precautions, *i.e.* correct feeding, good hygienic conditions, prevention of infections, and the supply of adequate quantities of vitamin D, or ultra-violet radiation, as well as the maintenance of a normal calcium-phosphorus metabolism and balance by all and every available means.

Curative. For dietetic measures see rickets (page 96). The general treatment of tetany is the same as that described as suitable for alkalosis (see page 326), that is to say the administration of calcium chloride for preference, or other acidosis-producing drugs.

For the carpo-pedal contractions or general convulsions, emergency measures are at times necessary, since the calcium chloride or acid treatment prescribed to correct the faulty blood condition may have a delayed action. Morphine given hypodermically is the drug of election, but it must be given in the first instance with extreme caution in view of a possible idiosyncrasy, 1/1000 of a grain for every pound of body-weight may be considered a safe initial dose, that is to say, 1/50 of a grain for an average infant 1 year old. After 6 hours the dose may be confidently repeated if it has given good results. Chloral and bromide may also be given, possibly best in combination, 1 grain of the former and 5 grains of the latter, repeated at three-hourly intervals. In severe cases a whiff of chloroform may be given to allow time for the slower acting drugs to become effective.

In the treatment of the common or infantile form of tetany

my personal experience is that there is no treatment so effective as the administration of phosphorus dissolved in cod-liver oil. It seems to me to have a definitely specific action. I usually give up to 1 drachm of cod-liver oil in which phosphorus has been dissolved up to the strength of 1 in 4000, and this dose is repeated three times in the 24 hours (page 699). In some way at present unexplained, this treatment seems to restore the calcium-phosphorus balance. This line of treatment need not exclude the orthodox use of calcium chloride.

CHAPTER XI

THE GENITO-URINARY SYSTEM

Malformations and Congenital Defects of the Upper Urinary Tract

Although various congenital defects of the upper urinary tract are occasionally met with, there are not many which lend themselves sufficiently to remedial treatment to come within the scope of this book.

Most of these developmental anomalies lead to immediate or ultimate obstruction to the outflow of urine, with subsequent hydro-nephrosis or hydro-ureter, secondary uræmia, renal insufficiency, or pyuria from infection. The diagnosis of the exact nature of the primary defect has been greatly facilitated by improved methods of cystoscopy and pyelography, and these should be utilized to the full in order that such treatment as is possible may be immediately applied.

Treatment. Treatment is almost entirely surgical, and the nature of the operation, if any, will depend on the character of the primary defect. Relief can sometimes be obtained by dealing with valvular or other obstructions at the ureteral (ureterocele) or urethral orifices of the bladder, and occasionally by dilating ureteral strictures. In unilateral cases with compensatory hypertrophy of the sound kidney, nephrectomy may be practised without grave risk.

ABNORMALITIES OF THE URETERS

Hydro-ureter, and Pyo-ureter

Abnormalities of the ureters include duplications and strictures, together with valvular and other obstructions. Any one of these may interfere with the urinary outflow and cause dilatation of the ureters with hydro-ureter, pyo-ureter, hydro-nephrosis, or pyo-nephrosis.

It is not always possible to find the exact cause of the interference with the urinary stream, but the site of obstruction can

usually be revealed by modern methods of cystoscopy or pyelography. Some cases occur in which even post-mortem no cause of obstruction can be found, and these are generally described as congenital or idiopathic, and there appears to be some analogy between them and cases of Hirschsprung's disease. They may be due to some defect in the nervous control of the motor functions by which the urine is discharged. In certain of these cases there are other developmental defects, as for instance, absence of the recti-abdominis muscles. In these latter cases there is great hypertrophy of the bladder-wall, which takes place in response to the increased functional activity which is imposed upon it owing to the absence of the recti muscles. It is tempting to explain this thickening of the bladder wall as the possible cause of the obstruction at the ureteral orifice.

With a valvular obstruction of the urethra at its junction with the bladder, the walls of the latter are not so much hypertrophied as that the bladder as a whole is dilated. While in the case of absence of the recti muscles, there is hypertrophy without dilatation. One of the most remarkable cases of hydro-ureter which I have met with was in the case of an infant 9 months of age in which the ureters were so greatly enlarged and convoluted that they could easily be felt per rectum, and at times could be seen presenting at the inguinal rings, like a hernia or hydrocele.[1]

Treatment. *Prophylactic.* There is no known means of preventing this condition.

Curative. The treatment is essentially surgical, but the exact nature of the operation will depend on the diagnosis of the site of obstruction, its nature, and the secondary results produced. In all cases the functional efficiency of the kidney must be estimated. In a few cases good results have followed from operations for the removal of valvular obstructions of the urethra, and the division of aberrant renal vessels which cause a kinking to, or an obstruction of the ureter at its junction with the kidney pelvis. Success too has followed the surgical treatment of ureteroceles, and stenosis of the ureteral opening into the bladder.

Hydro-nephrosis, and Pyo-nephrosis.

Both of these are secondary to interference with the urinary flow by reason of hydro-ureter or other cause (see page 330). The trouble may be unilateral or bilateral, and of the closed, intermittent, or open type. The closed type is generally caused by constriction of the ureter at the pelvi-ureteral junction, which may be complete at the time of birth, or become so later. The

[1] *Proc. Roy. Soc. Med. Sect. Dis. Child.*, vol. vii, p. 68, Jan., 1914.

intermittent type is the more common, and also may be unilateral or bilateral, and it may develop later into the closed type.

The causes are congenital stricture of the ureter, aberrant renal vessels, or calculi. Any temporary blocking of the urinary outflow may bring about a sharp attack of renal colic.

The open type is always bilateral, and seldom reaches a great size. The ureters are enlarged and tortuous, but there is no interference with the urinary flow into the bladder, and the ureteral openings are large and gaping. The cause is generally obstruction of the ureter at its junction with the bladder.

Treatment. The treatment, like that of hydro-ureter, is essentially surgical and consists in attempts to remove the cause of the obstruction, or of a seriously diseased kidney which has become functionless. In all cases, before operation, the renal efficiency of the other kidney should be estimated.

ANOMALIES OF THE BLADDER

Troubles connected with the bladder in infants and young children usually take the form of cystitis, ulceration, fistulæ, diverticulation, sacculation, calculi, nævi, foreign bodies, and neoplasms, but the majority of these conditions are so rare that they require no detailed description here, with the exception of cystitis.

Cystitis

Cystitis can hardly in itself be regarded as a disease entity, but rather as a symptom secondary to infection, or to one or other of the above conditions. In most cases the symptom is relieved by alkaline treatment and the administration of a urinary antiseptic, such as hexamine or caprokol. Local treatment consists in the irrigation of the bladder with a solution of 1 per cent mercurochrome.

MALFORMATIONS OF THE PENIS

Hypospadias

In this condition the urethra opens on the ventral aspect of the penis at any point between the tip of the glans and the membranous portion. There is no interference with control of urination but only as regards direction of flow.

Treatment. Minor degrees of this condition require no treatment beyond a possible dilatation of a stenosed meatus. Although

hypospadias does not eventually interfere with coitus, there is some reason to believe that on mechanical grounds at least, it renders successful impregnation of the female extremely unlikely. Plastic operations for the correction of the deformity are difficult and should be postponed until the child is 6 or more years old.

Epispadias

This is much less common than the foregoing. It is often accompanied by other developmental defects, such as undescended testicle or inguinal hernia. It gives more inconvenience than hypospadias for the reason that the sphincter of the bladder is usually involved, causing loss of urinary control and secondary complications.

Treatment. The operation which is generally necessitated owing to the secondary effects of urinary incontinence, is usually performed in two or more stages, the first being concerned with the restoration of the internal sphincter of the bladder, and further operations with the plastic repair of the penile portion of the urethra. The first operation should be performed at the earliest possible date in order that eczema or cystitis may not interfere with the success of a delayed operation. Second or later stages of the operation can be postponed as in the case of hypospadias.

ABNORMALITIES OF THE PENIS

Phimosis

Phimosis, which literally means " muzzling," is a term applied to stenosis of the preputial opening, which prevents the foreskin from being retracted so as to expose the whole of the glans. Sometimes retraction is interfered with by adhesions between the prepuce and the glans, which are sufficiently fibrous and tough to require definite division with the knife. At other times the adherent surfaces are easily separated by gentle manipulation, or by breaking down adhesions with a probe. The belief that enuresis, masturbation, convulsions, hernia, or pyloric spasm, are due to phimosis, is founded on very slender evidence, though it may be a contributory factor in the etiology. Great degrees of stenosis of the preputial meatus do not appear to cause straining on micturition. Infants with pin-point openings, so small indeed that they can scarcely be detected with the naked eye, usually pass a perfectly free stream of urine without effort. On the other hand, the local irritation or inflammation which

follows a phimosis sometimes predisposes to reflex or voluntary retention of urine.

In all cases in which free retraction is interfered with from stenosis or adhesions, the operation of circumcision should be performed, or the adhesions broken down and the meatus stretched, otherwise concretions may accumulate in the preputial sac which may lead to local inflammation. These concretions (smegma) consist of exfoliated and degenerated epithelial cells from the surface of the glans. They are sometimes impregnated with phosphates and other salts from the urine, or with sebaceous secretions from the glandulæ Tysonii odoriferæ. From motives of cleanliness, and also as a prophylactic against subsequent venereal infection, or difficulties in coitus, there should be no hesitation in performing the operation of circumcision if the local circumstances seem to necessitate such a step, or interfere with complete retraction of the foreskin.

The age at which the operation should be performed is often a problem for the practitioner to solve. In my opinion it should not be delayed later than the 14th day if retraction is impossible owing to adhesion or stenosis, or at any age in which local inflammation arises from such causes. It should in all cases be performed by a competent surgeon, as various troubles and difficulties are liable to arise from the imperfect separation of existing adhesions, or the formation of new ones owing to a defective surgical technique.

Paraphimosis

Paraphimosis is a term applied to constriction of the penis which occurs just behind the corona when a retracted and tight foreskin becomes œdematous and cannot be released by ordinary manipulation. Strangulation from this cause is often difficult to overcome. It has been known to cause gangrene of the prepuce and glans.

Treatment. *Prophylactic.* Regular withdrawal of the prepuce, stretching of a stenosed opening, and washing to remove accumulated smegma, are the chief means of prevention.

Curative. Ice or evaporating lotions should be applied to the œdematous parts of the penis and the pressure should be exercised by the two thumbs on the congested glans, while with the fingers efforts should be made simultaneously to bring forward the incarcerated prepuce and restore it to its normal position. If these simple measures fail, the penis should be completely bandaged from the tip downwards, so as to reduce the œdema, and allow of the release of the prepuce. If, however, these manipula-

tions are unsuccessful, a director should be inserted beneath the constricting band and the ring incised vertically with a bistoury. The prepuce can then be restored to its normal position and the incision stitched up.

Balanitis

Balanitis, or inflammation of the prepuce, almost always implicates the mucous membrane of the glans itself, and more appropriately should be called balano-posthitis.

Treatment. *Prophylactic.* Frequent withdrawing of the prepuce, and washing of the glans to remove smegma is the best preventive. Contact of the prepuce with a napkin or other article of clothing which has become saturated with urine is a fruitful cause of balanitis, so also is an acid or irritating condition of the urine itself, such as occurs in acidosis, or during teething. Free administration of bicarbonate of soda by the mouth is the best preventive.

Curative. Bicarbonate of soda by the mouth, and the local application of boracic acid fomentations.

Urethritis

Urethritis, whether due to gonococcal or other form of infection, is rare in babies and young children, though temporary inflammation of the urethra is sometimes set up by gravel or acidity of the urine.

Treatment. This is the same as that for urethritis in adult individuals, and consists in rendering the urine alkaline by citrate or bicarbonate of sodium, and by giving Tincture of Hyoscyamus (see page 698) to relieve spasm. Local treatment consists in the irrigation of the urethra with a 1 per cent solution of mercurochrome. Local ulceration of the meatus or glandular portion of the urethra, which scarcely deserves to be called urethritis, is best treated by the insertion into the meatus of a small quantity of bismuth ointment after each act of micturition, to prevent adhesion of the ulcerated mucous surfaces of the orifice, and subsequent tearing apart on micturition.

Undescended Testicle

An undescended testicle is nearly always accompanied by a patent processus vaginalis and hernia. The gland itself is either incompletely developed from the first, or becomes atrophied in the course of time. In bilateral cases, which are rare, sterility is the rule, certain infantile characteristics persist, and there is

want of complete development of the secondary sexual characteristics.

Treatment. Spontaneous descent may occur at any time up to the age of 14, but as a rule, without operation the testicle fails to descend into its normal situation, and under such conditions almost certainly atrophies.

The arguments for operation greatly outweigh those for non-interference. In the first place, the hernia which usually complicates the condition is an actual or potential source of danger and requires attention. Secondly, the fixation of the testicle in its proper situation in the scrotum affords at least some opportunity for the organ to develop normally.

The best age for the operation is about 5 years, unless the condition is complicated by a hernia which gives trouble, or the condition is bilateral. In either of these circumstances, operation should be performed at an early date.

Testicular, or other endocrine extracts are in my experience quite useless, but good results have been reported in cases of cryptorchidism by the administration of Antuitrin "S," which is a standardized highly purified extract of pregnancy urine, and contains an anterior-pituitary-like sex hormone. Dose 5 minims injected intra-muscularly every week.

Ectopia Testis

In the course of its descent the testicle may wander from its normal path, and reach one of the following aberrant positions :

1. The external oblique aponeurosis (iliac).
2. Between the anus and the scrotum (perineal).
3. Scarpa's triangle (femoral).

Treatment. In all these cases a plastic operation must be performed as soon as the abnormality is discovered. The testicle can as a rule be easily restored to its normal position, as there is no shortening of the spermatic cord.

DISEASES OF THE KIDNEY

Although in accordance with modern views of their pathogenesis the various forms of Bright's disease ought to be respectively distinguished as nephritides (inflammatory), nephroses (degenerative), and arterio-scleroses, from the standpoint of treatment it is perhaps better to adhere to the old nomenclature of—

1. Glomerular Nephritis.
2. Tubular Nephritis.
3. Chronic Interstitial Nephritis.

Although in their acute forms the first two varieties can usually be distinguished from one another by their symptoms and etiology, in their more chronic manifestations they tend to merge the one into the other, and finally to assume a fibrotic condition not altogether unlike the third variety, namely, chronic interstitial nephritis.

In the following account, the old terminology has been adhered to.

Glomerular Nephritis

In both its acute and chronic forms glomerular nephritis is much the commonest variety of Bright's disease found in infancy and childhood. Its distinguishing features are the presence of blood in the urine, often in considerable amount, a small quantity of albumin, and few renal elements. There is little œdema, and only a mild degree of uræmia. The blood pressure is not appreciably raised. The attack usually commences about 3 weeks after some acute infection of the upper air-passages, generally streptococcal, but the primary infection may be one of many other forms, such as pneumonia, empyema, diphtheria, sinusitis, mastoiditis, contagious impetigo, erysipelas, or other infective conditions of the skin, such as eczema.

Treatment. *Prophylactic.* In view of the fact that this form of nephritis is commonly preceded by an acute infection, prophylactic measures must be mainly directed towards the detection of the premonitory symptoms, before the renal complications assume a serious form, and if discovered they must be dealt with while they are still amenable to treatment. The early symptoms are for the most part the presence of blood cells in the urine, albuminuria, and bacilluria. It is often possible to detect by examination of the urine the presence of the same organisms as are responsible for the primary infection, and thus by appropriate treatment to cut short an attack which might otherwise go on to a severe form of glomerular nephritis.

The treatment in these early stages is to give alkalies and caprokol as described in the section on infections of the urinary tract (see page 351). This method is superior to the giving of hexamine, which cannot be combined with an alkaline treatment. It must be remembered that the chronic forms of glomerular nephritis are usually the result of a succession of acute and possibly minor attacks and therefore preventive measures should include the taking of all possible precautions against recurrences of a primary infection no matter how slight in degree.

Curative. The indications for treatment are:

(1) The removal of the primary focus of infection.

(2) Giving the kidney as little work to do as possible.

(3) To relieve general symptoms, and special complications as they occur.

(1) Treatment of the Primary Infection. The immediate removal of any existing focus of infection, if it can be discovered, is obviously a fundamental precept of the treatment. But however desirable it may be to remove the original source of the trouble by the extraction of a carious tooth, or the opening of an abscess, each case must be treated on its merits, and a surgical operation only undertaken after duly weighing possible contingencies.

(2) Relief of the Kidneys. As regards relieving the work of the kidneys, restriction of the total quantity of food is the most direct means of securing this end. If the child is kept warm in bed and immobilized, the caloric requirements can be reduced to a minimum. Such restrictions apply mainly to nitrogenous foods, since as the result of their metabolism waste products are formed which can only be excreted by glomerular activity. It is generally considered that the loss of protein by the albuminuria calls for compensation by means of an increased consumption of nitrogenous foods, but albuminuria is to some extent a self-limiting symptom, and can be increased or decreased by the amount of protein food consumed. As the result of considerable experience in dieting infants and young children suffering from the glomerular type of nephritis, I can confidently reassure those who have doubts on this subject, that recovery is expedited and not retarded by a strict limitation of nitrogenous foods, including milk.

At the commencement of an acute attack it is politic to exclude proteins entirely from the dietary and to allow the child to subsist exclusively on carbohydrate food, which may shortly be varied by the addition of weak tea, and orange or other fruit juices. At the end of the 3rd or 4th day such a strict diet may be replaced by an ordinary simple diet consisting largely of cereals, vegetables and fruit, with a modicum of milk. Meat, fish, eggs, and meat essences or soups should be avoided until convalescence has set in. In the case of young infants who are breast fed, difficulty arises in the restriction of the protein intake. The amount of protein however can be controlled by limiting the amount of actual breast milk consumed by means of the "Test Feed," and supplementing the deficiency with some simple carbohydrate food such as Horlick's Malted Milk.

The amount of fluid to be allowed will depend very largely on

the quantity excreted by the kidneys. In the early and acute stages when marked oliguria, and perhaps a tendency to œdema of the tissues is present, the amount must be restricted. But as the hæmorrhage and œdema disappear and the glomeruli assume their normal functions, the quantity of water may be gradually increased up to normal, but there is in my opinion no advantage in giving excessive quantities of fluid in the hope of "flushing out the system."

Drug Treatment. Diuretic drugs, such as diuretin, caffeine, liquor ammonii acetatis, are of questionable value in the case of glomerular nephritis. The indication is to relieve the kidneys of their load, and not to stimulate them. The only drugs required are simple alkalies, such as citrate of potassium, and bicarbonate of soda. Some authorities think it is better to give potassium salts exclusively, and to avoid sodium in any form. For my part, I think that the two bases are better mixed, and that in ordinary cases, 5 grains of citrate of potassium combined with 5 grains sodium bicarbonate, given three times a day, fulfils the requirements. Personally, I do not advocate the use of either diaphoretics or aperients, but advise rather the relief of the kidneys by a curtailed allowance of fluid, since both diaphoresis and looseness of the bowels introduce their own complications.

Owing to the general restriction of fluid intake in the early stages of glomerular nephritis, some degree of constipation is quite likely to result. This can easily be corrected by Milk of Magnesia, to the extent of 1 drachm daily. With complete or serious suppression of the renal functions, or with a general œdema of the tissues, it may be necessary to promote the activity of the skin. This is better done by mechanical means than by drugs, and the best procedure is to apply dry heat by means of a hot-air bath. This is a much better plan than to give a hot bath, or a steam bath, both of which inhibit evaporation through the skin, and thus deprive the skin of its natural stimulus to activity.

(3) Treatment of Complications.

(*i*) *Pain in the Back.* Severe backache is one of the common complications of acute glomerular nephritis. This may be relieved by dry cupping, turpentine stoups, or the application of a mustard or Kaolin plaster (Cataplasma Kaolini). These should be applied to the loins.

(*ii*) *Ketosis.* This is a frequent complication, especially when there is much vomiting, or diarrhœa. It is best treated by glucose, and alkalies, if the latter have not already been given as part of the general treatment.

(*iii*) *General Œdema.* Severe degrees of œdema are very rare in this form of nephritis. If it occurs it is best controlled by the limitation of fluid.

(*iv*) *Œdema of the Glottis.* This is a special complication which very rarely occurs, but when it does it is extremely alarming. The treatment is by scarification of the tissues involved.

(*v*) *Uræmic Symptoms, Pleurisy, Pneumonia, Pericarditis, Endocarditis.* All of these are occasionally complications, and should be treated in accordance with the directions given under their specific headings.

Tubular Nephritis

(Parenchymatous Nephritis : Large White Kidney : Nephrosis)

Instances of this particular type of Bright's disease are very rare in infants under 1 year of age. They are fairly common between 1 and 5 years of age.

The symptoms are due to a degeneration or infiltration of the tubular epithelium, rather than to an inflammation, and hence in accordance with the modern nomenclature they have been described as nephroses, rather than as nephritides. The etiology of the condition is imperfectly understood. Some cases appear to commence insidiously, although in others there may be a history of infection of the upper respiratory passages, as in the case of glomerular nephritis, but the preceding infection is not of so definite and distinctive a character. Clinically, the tubular variety is to be distinguished by the existence of pallor, oliguria, œdema, albuminuria, and excess of cholesterol in the blood, and a deficiency of chlorides in the urine. Hæmaturia is generally absent. Pathologically the condition is characterized by involvement of the tubular epithelium, which is of a degenerative and infiltrative character, rather than inflammatory. The urine, which is always reduced in quantity, contains large amounts of albumin, leucocytes, and renal elements, but red blood cells and chlorides are noticeably absent. There is a great tendency for relapses to occur, and probably chronic cases represent the final stage of a succession of attacks from which complete recovery has never taken place. A few of the more chronic cases pass into a condition of fibrosis, which can only be distinguished with difficulty from that of chronic interstitial nephritis.

Treatment. *Prophylactic.* Since the etiology of this variety of kidney disease is not definitely known, all that can be done in the way of prevention is to act on the supposition that these

cases, like those of the glomerular type, are infective in origin, and as such, are best prevented by the same precautions that were advised in the case of glomerular nephritis.

Curative. The indications for treatment are firstly, the eradication of any discoverable focus of infection; secondly, the regulation of the dietary; thirdly, the relief of œdema; and fourthly, the handling of complications.

As regards the sources of infection, these are believed to be mainly of the pneumococcal, and streptococcal variety. Attention must be particularly directed to the teeth, tonsils, and ears, and if any of these are found to require treatment, surgical intervention is indicated at the first favourable opportunity that occurs, for a cure of the kidney condition cannot be expedited if it is due to an unrelieved focus of infection.

As for diet, in these cases the necessity for restricted nitrogenous food is not so pressing as in the case of glomerular involvement, and chiefly for the reason that there is as a rule no nitrogenous retention. All the same, I do not advise any increase of protein food to compensate for the loss of albumin in the urine. In the acute stages of the disease the child must be confined to bed, and consequently has only limited requirements for fuel food. Under these circumstances he may be under-caloried with safety.

In all cases with œdema, it is desirable to reduce the amount of salt and fluid. For the relief of the œdema neither purging, sweating, nor the use of diuretics is indicated. As soon as the œdema has subsided restriction of salt and fluid intake may be gradually omitted. If the œdema however continues to increase in spite of limitation of fluid, the condition may be mitigated by producing free sweating. For this purpose the suspension of electric lamps from the bars of a fracture cradle is a convenient method of promoting the activity of the skin. Electric blankets (Thermega, see page 121) answer the same purpose. These expedients are better than the ordinary hot bath, which only interferes with evaporation from the skin, and gives a false impression of sweating. Diuretic drugs, such as diuretine, theo-bromine, theophyllin, or theocine, are drugs which are sometimes employed for diuretic purposes, but should only be used with caution, as they may irritate as well as stimulate the renal parenchyma. The administration of citrate of potassium in combination with bicarbonate of sodium, is the safest, and on the whole the most reliable form of drug treatment in these cases.

In all cases of tubular nephritis, one of the chief problems is to determine how long to continue active treatment, and how long to

maintain the child in bed. A limited diet and complete passive immobilization is debilitating, and cannot safely be continued for any great length of time, but bearing in mind the great tendency to relapses or fresh attacks which interfere with permanent recovery or lead to chronic conditions, one must not be lulled into complaisance or misled by the absence of œdema and other symptoms into the belief that a complete cure has been effected, and that active treatment may be remitted.

Reduced Basal Metabolism. In tubular nephritis there is commonly a reduction in the basal metabolism rate. This to my mind is all to the good, as it represents a conservative reaction to relieve the kidney of part of its load, in eliminating products of metabolism. Some authorities, however, regard it as an indication for the giving of thyroid preparations to stimulate the vital processes. Personally, I have never seen any benefit from this form of treatment.

Decapsulation of the Kidney. In very severe cases of tubular nephritis which do not respond to ordinary medical treatment, the operation of decapsulation has been recommended. What the exact effect of this procedure is, nobody appears to be able to say, but all the same in certain cases it has been followed by good results. It may be that with decapsulation new blood-vessels grow from the surrounding structures, and entering the substance of the kidney improve the vascular supply. On the other hand, it may simply act in relieving tension. In the event of failure of all other methods to effect relief of serious symptoms, this operation may be justifiable in skilful hands.

Chronic Interstitial Nephritis

(Chronic Nephrosis and Renal Sclerosis)

Although occasionally chronic cases of both glomerular and tubular nephritis develop the signs and symptoms of an interstitial nephritis, there are yet others which are not suggestive of any such origin, and which occur at so early an age that it is impossible to believe that they are secondary to previous and unrecognized attacks of parenchymatous disease. In most cases there is no history of any previous infection, nor of urinary stasis with an ascending nephritis, but the disease commences in an insidious manner with a general impairment of health, and other symptoms and signs which suggest congenital or hereditary degeneration of the kidneys. There is usually polyuria, thirst, anorexia, and bony deformities of the rickety type, which will be described a little later in a special section. The urine is of

low specific gravity, with traces of albumin, low urea content (1 per cent), hyalo-granular casts, and also a few red blood cells. The blood shows increased nitrogenous retention, secondary anæmia, with increased phosphorus and decreased calcium content. Renal efficiency tests reveal functional impairment. Blood pressure is increased, and there is often cardiac hypertrophy.

The disease is progressive and death usually occurs from uræmia. The condition of the kidneys is one of general fibrosis. They are small, scarred, and occasionally cystic, while the capsule is thickened and adherent.

Treatment. *Prophylactic.* This is definitely unsatisfactory, except in so far that a small minority of cases which appear in later childhood represent the chronic stages of either glomerular or tubular nephritis. Such cases by the exercise of great care may occasionally be prevented from developing into chronic forms by the preventive means described under their appropriate headings. However, the great majority of instances of interstitial nephritis in children are probably of a primary degenerative character, and as such are obviously incapable of being dealt with by prophylactic means. To what degree, or to what extent the early diagnosis of the condition would prevent extension of the degenerative process is very questionable, but on theoretical grounds the earlier the treatment is commenced, the slower will be the progress of the disease, the less serious its symptoms, and the longer the expectation of life.

Curative. The treatment in these cases must be largely directed to that of the uræmia, the hypertension, and the acidosis. All these demand restriction of protein, and sodium chloride, with the free administration of alkalies, which should at least in part consist of potassium salts. The diet should be largely of a vegetarian, cereal, and fruitarian nature, with only a limited quantity of milk. Although elimination of waste nitrogenous products may be assisted, and the kidneys correspondingly relieved, by free purgation and diaphoresis, these measures are only of secondary importance as compared with those which are directed towards the reduction of waste products by limitation of the protein intake, and a general suppression of the metabolic processes by warmth and rest in bed.

Complications such as heart failure, uræmic conditions, acidosis, and bony deformities, must be treated in accordance with the directions given under their corresponding headings.

Renal Rickets

(Renal Dwarfism : Renal Infantilism)

Quite a considerable number of cases of Renal Rickets have recently been placed on record. No doubt such cases have always existed, but their renal origin has not been understood. The condition may arise in almost any case of chronic nephritis which runs a sufficiently protracted course during periods of active growth, but especially in those cases of chronic interstitial nephritis which exist from birth, and even before, and for which no other etiological explanation is forthcoming than that of a congenital structural fault in the kidney (congenital hypo-plastic kidney). Certain cases have been met with in which there has been urinary stasis in the ureters or elsewhere, with an ascending nephritis.

The symptoms are mainly those of ordinary chronic interstitial nephritis, with the addition of certain structural deformities of bone. The X-ray evidences show an active rickety condition. The urinary findings are those of failure of renal function. The phosphorus content of the blood may be enormously increased, up to 10–15 mg. per 100 c.c. of blood plasma. The calcium content on the other hand may be very greatly reduced, with accompanying evidence of spasmophilia, Chvostek's sign, tetany, and laryngismus.

Treatment. The treatment is the same as that for chronic interstitial nephritis, and is from the point of view of both prophylaxis and cure extremely unsatisfactory. The specific treatment includes combating the calcium shortage in the blood by the administration of calcium lactate, and the counteraction of the acidosis which usually accompanies it by the free administration of alkaline drugs.

FUNCTIONAL DISTURBANCES OF THE URINARY TRACT

Enuresis

Enuresis has been defined as the involuntary passage of urine, not in my opinion a very satisfactory definition. The term however is usually reserved for incontinence and frequency of micturition by day or night, or both combined. The condition has little significance in the case of babies or young children who have not been successfully trained or who have not yet reached an age at which they should have some degree of voluntary control over the bladder function. The time at which control of this

function is attained depends very largely on the manner in which the infant has been brought up, that is to say, it depends on the mother's or nurse's skill and perseverance, but it not infrequently happens that there are lapses from good habits after the child has been perfectly trained, under conditions of nervous disturbances, both of psychic and physical origin.

Diurnal Enuresis.

With incontinence during the day in the case of children who should have already acquired control of the bladder functions, a clear distinction should be drawn between incontinence which is due to physical causes such as cystitis, pyelitis, diabetes, or tuberculous kidney, and those which are due to nervous instability, mental defect, or ineducability. To whatever type the diurnal enuresis may belong, however, it is almost certainly accompanied by nocturnal lapses also.

Diurnal Enuresis due to Definite Physical Causes. It is a very comforting explanation to parents when a definite physical basis, such as phimosis, *atresia meati*, enlarged tonsils, urethral valves, syphilis, acid conditions of the urine, spina bifida, constipation, worms, or scybala in the rectum, can be assigned as a cause for the enuresis, and that treatment of these causative factors is likely to cure the symptom. But beyond the fact that certain of these conditions may in some measure be contributory causes, I think it may be definitely accepted that very few cases of diurnal enuresis are due to such organic causes, and that the great majority of them are of functional origin, and occur in nervous, excitable, suggestible, and precocious children. The record of successful cures of enuresis by surgical operations must not be accepted as evidence of a causal connection between the symptom and the condition for which the operation is undertaken. In the great majority of such cases success is due to the cure of a functional disorder by suggestion of a very impressive character. The only organic causes of diurnal enuresis commonly met with are pyelitis, cystitis, tuberculous kidney, calculi, and urethral malformations. If these or any other urological basis can be found for the symptoms, the appropriate lines of treatment, as described under their several headings, must be applied.

Functional Causes of Diurnal Enuresis. In a sense this condition is a neurosis. It has been described as a hysterical manifestation, which is often made worse by the solicitude of parents and nurses. Suggestions of all kinds, including auto-suggestion, is, in the case of sensitive and impressionable children, a prolific source of the trouble. Owing to this psychopathic element in the etiology of these cases, the treatment must also be psychiatric

in character and directed to the restoration of confidence, and to the acquisition of voluntary control over this automatic reflex. Punishment and harshness in the treatment are useless, and even sympathy can be overdone. An intelligent understanding of the essential cause, however, will gradually help in the cure. As in the case of nocturnal enuresis, presently to be described, it is my experience that actual hypnotic suggestion afforded by an expert, and the educational influence of a graduated distension of the bladder by the injection of water, are of great practical value. I recently admitted to the wards of The Infants Hospital a series of cases of very inveterate functional diurnal enuresis, which were treated by the bladder distension method, that is to say, by means of catheter and douche-can the bladder was gradually distended and rendered capable of holding 4–5 oz. of water, although at the beginning of treatment some of them were unable to retain more than 1 oz. By gradually increasing the quantity of water injected, and by encouraging the child to retain it for a longer and longer period, a cure was in most cases effected in the course of 2 or 3 weeks. In all these cases the physical education was supplemented by the administration of arsenic, belladonna, and bromide, to steady and fortify the central nervous system.

Nocturnal Enuresis.

Nocturnal enuresis is quite a different story from incontinence by day, although the two conditions often coexist. When diurnal enuresis occurs, however, as an independent symptom, it represents the loss of, or non-acquisition of, voluntary control, whereas the nocturnal form represents failure of the subconscious or automatic centres to gain control of the bladder function. Although to some extent the habit of bed-wetting is influenced adversely by want of training and control of micturition during the day, it may develop in children of any age who previously have been quite free from bed-wetting. It is particularly likely to arise in precocious, quick, sensitive and suggestible children, with unstable nerve centres. Bed-wetting frequently occurs in mental defectives and backward children in spite of the best training and management, but in such cases failure of response to the educational régime runs a parallel course with slow progress of general mental development.

Any event which disturbs the mental or nervous equilibrium, such as a journey, a party, dentition, a new nurse, or a change of climate, may provoke or aggravate in sensitive children the frequency of the act. In the same way that every person, object, or event which can in any way remind the child of his past delinquencies, or is otherwise suggestive of the offence, is capable of

acting as a liberating stimulus of the reflex act. The common belief that bed-wetting can be cured by drugs, a change of diet, circumcision, tonsillectomy, administration of bicarbonate of soda to correct acidity of the urine, or the dislodgment of thread worms by an anthelmintic, is generally doomed to disappointment, as also is reliance on lines of treatment founded on the Freudian theories. The belief that bed-wetting is a prelude to masturbation, or nocturnal pollutions, is an equally unsatisfactory explanation.

Treatment. *Prophylactic.* The early training by holding out, and the establishment of regular habits in respect to micturition, is the only preventive measure of any real value, although every measure which makes for the stability of the nervous system in general, or of the micturition centre in particular, such as correct feeding, regulation of the bowels, a quiet well-ordered life, undisturbed sleep, adequate exercise, in fact every hygienic measure which can promote good health, has some prophylactic value of a non-specific nature. The only specific prophylactic is " good training " and this is by no means always reliable.

Curative. As regards the general management of these cases, it is important that the child should sleep comfortably and on his side, not on his back, in a well-aired room, with light and fairly warm bed clothing, and for preference in a cellular or Aertex sleeping-suit. The mattress should not be too soft, and there should be no sagging. It should be protected by a mackintosh sheet, but it is important that the child should not be aware of this precautionary measure lest it should act as a suggestion of a possible lapse. As for diet, over-feeding of any kind, and especially an excess of stimulating nitrogenous foods, are details of importance which should be carefully observed. Indigestible articles of food such as celery, beetroot, citron peel, cheese, currants, raisins, raw apples, mushrooms, and other hard cellulose-containing foods, should be avoided, as also should all other reflex causes of irritation, such as scybalous masses or worms in the rectum, or acid urine.

Psychological excitement, and disturbances, are equally obnoxious, and should be avoided, not because these causes are specific, but because they add to the causes of irritation which may provoke an explosion of an excitable nerve centre. As regards fluids, they should not be restricted, since such a procedure leads to concentration of the urine, with consequent reflex irritation of the mucous membrane of the bladder, but for the most part, fluids should be taken before four o'clock in the afternoon.

As for medicines, these should include the administration of alkalies to prevent any acidity of the urine, or indeed the develop-

ment of a general condition of acidosis, which may lead to a spasmophilic condition with increased irritability or explosiveness of the micturition centre. For the same reason calcium lactate is indicated. Petroleum Emulsion given in small repeated doses, rather than in one large one at night, serves as a useful lubricant and prevents any possible accumulation of scybala in the rectum. The old-fashioned combination of bromide, arsenic and belladonna (page 698), although having no specific actions in cases of bed-wetting, is often of value in conjunction with other means which promote the stability of the central nervous system.

However, none of these medicinal measures can be relied upon to cure inveterate cases of bed-wetting, nor do they compare in effectiveness with psychiatric expedients, such as the removal of adverse sources of suggestion, and the provision of those which have favourable influences. The child must be encouraged in every way to control the bladder function during the day by voluntary restraint, and everything suggestive of the act should be kept out of the child's sight or hearing, such for instance as the existence of a mackintosh sheet on the bed, or conversations about lapses during the night. Among the favourable forms of suggestion, a complete change of environment, which includes not only a change of place but of personnel, is often of the greatest value. Direct forms of suggestion, such as the frequent repetition of such sentences as "You will be good to-night," if made when the child is just going off to sleep and the sub-conscious centres are taking the place of the conscious, will often be very effective. I have had many instances of the value of this method of treatment when it has been administered by an intelligent nurse or mother.

In long-standing and difficult cases I have found that the best prospect of successful treatment lies in the making of one concentrated and concerted effort by bringing all one's therapeutic guns to bear on the objective at the same moment, as for instance, by simultaneously providing a complete change of scene and personnel, by focusing all the influences and suggestions which can achieve the desired end in the same direction, especially suggestions which tend to make the child believe that a cure is in sight, and by combining all these with every possible hygienic measure which can improve the general health of the child, and at the same time giving really big doses of bromide, arsenic, and belladonna, all of which should be given up to the limit of tolerance.

If all such means fail, and they do occasionally fail, there is the final appeal to hypnotic suggestion given by a professional expert. I have witnessed some very dramatic cures effected by this means. Operative treatment, such as the injection of normal

saline into the peritoneum, or the transplantation of the gracilis muscle to provide a new sphincter urethræ, are proceedings which should never be contemplated in the case of young children, even if they have met with some success in the case of older persons.

Retention of Urine

Reflex retention of urine may occur in the case of babies or young children from any condition in which micturition is, or has previously been accompanied with pain, as for instance, when there is a sore or ulcerated condition of the meatus, or when a calculus has been passed. It may also occur from organic causes, as for instance, deformities or anomalies of structure of the urinary tract, such as congenital strictures, duplications or valve-like folds of the mucous membrane, from the presence of foreign bodies, calculi, concretions, or new growths of the urinary organs. It may also be caused by lesions of the Central Nervous System, such as cerebral tumours, cord injuries, spina bifida, or peripheral neuritis following acute infections interfering with the muscular functions of the bladder.

Diagnosis of the cause is naturally important, and will determine the character of the treatment. In all cases the possibility of infection of the urinary tract secondary to retention must be borne in mind. X-rays sometimes help in detecting the site of the obstruction, while both cystoscopy and cystography may also be employed to reveal the cause of organic abnormalities of the urinary apparatus, which result in retention. In all cases of doubt a careful neurological examination should be made, and a Wassermann test applied.

Treatment. Treatment is most unsatisfactory in cases of retention due to central nervous causes, or congenital malformations. In retention from pain, or from other reflex causes the prospects are more hopeful, and can usually be dealt with by careful catheterization with precautions to prevent secondary infections of the urinary tract. Slow evacuation of the urine is essential in cases of severe retention.

If any local cause can be discovered it should be treated by appropriate means. With raw or adherent surfaces of the meatus the best treatment is to insert bismuth ointment into the urethral orifice after each act of micturition. This prevents the adhesion of the raw surfaces.

Suppression of Urine

Entire or partial suppression of urine occasionally occurs in infants and young children, and must be distinguished from

retention. This can be done by palpation and percussion of the bladder, which in the case of suppression is completely empty.

Suppression may occur in cases of severe nephritis, or from carbolic acid or turpentine poisoning. Partial suppression may occur in conditions of dehydration.

In cases of temporary suppression or oliguria there is no need for anxiety, it can usually be cured by a hot bath, a hot drink, and a dose of a simple diuretic, such as Mindererus (Liquor Ammonii Acetatis dilutus), which may be given to the extent of ½ drachm.

ABNORMAL CONDITIONS OF THE URINE

Lithiasis

This may take the form of calculi or gravel present in the kidneys, ureters, bladder, or urethra. A stone may be impacted, giving rise to obstruction, or pain on micturition. The calculus may consist of urates, phosphates, cystine, or any combination of them. The position of the stone may be revealed by radiography, cystoscopy, or pyelography.

Uric Acid and Urates

Uric acid is normally present in excess in the urine of new-born infants. This phase usually lasts for about 10 days and covers the so-called "Uric Acid Infarct period." Later it may take the form of gravel in the urine, and give rise to painful micturition or hæmaturia. I have met with one or two cases in which infarction of amorphous urates in the urethra has led to temporary retention of urine in the case of new-born infants. The obstruction can however usually be removed by the passage of a soft rubber catheter.

Deposits of urates may occasionally occur in the case of infants and young children in other situations than in the urinary tract, giving rise to what may be called a gouty condition, but cases of this kind are so rare that they may be said to be non-existent at this period of life.

Treatment. In all cases of uric acid calculi, infarcts, or gravel, the treatment is quite simple, and consists in the administration of alkalies, such as bicarbonate of soda, citrate of potash, and citrate of soda, in sufficient amounts to render the urine alkaline. The treatment is assisted by the free exhibition of water and the limitation of nitrogenous foods.

Phosphaturia

This condition is represented by an excess of phosphates in the urine, which is usually evidenced by cloudiness of the urine on standing or boiling, and which disappears on the addition of acid. The condition need not give rise to any anxiety as it is generally due to the existence of an acidosis which can be easily cured by the administration of alkalies. It may however also occur when large quantities of phosphates are produced in the system by the metabolism of nucleo-proteins or phospho-proteins, or the excessive intake of milk, or in cases of leukæmia or leukocytosis, in which there is an excessive destruction of white cells.

Treatment. In all cases of phosphaturia the administration of alkalies is indicated.

Cystinuria

Cystinuria represents one of the "in-born errors of metabolism." Cystine itself is one of the amino-acids which make up the protein complex. It contains a large amount of sulphur, and for some reason at present unexplained in cases of cystinuria the cystine is not broken down into its simple and ultimate products of metabolism by the deaminating functions of the liver. It appears unchanged in the urine in the form of crystals which may be easily recognized by their characteristic shape.

Treatment. The treatment is the limitation of the protein diet, and the free administration of alkalies in which the crystals are soluble.

Pyuria and Bacilluria

Infections of the urinary tract, whether complicated by the presence of pus (pyuria), or characterized simply by the presence of bacilli in the urine (bacilluria), are extremely common both in babies and young children, and are very often the cause of otherwise inexplicable periods of high temperature. The infective organism is generally the colon bacillus, but any one of the following varieties may occasionally be met with: The Streptococcus, staphylococcus, pneumococcus, bacillus typhosus, and para-typhosus, dysentery bacillus, gonococcus, bacillus proteus, and bacillus piocyaneus. Mixed infections are not uncommon, and a few cases of streptothryx infection have been recorded.

The path of the infection may be any one of the three following:

1. Hæmatogenous—through the blood-stream.
2. Ascending, from the lower urinary tract.
3. Trans-parietal from some contiguous organ, as the appendix, presumably through the lymphatics.

The belief is now becoming more general that stasis in the urinary flow, due to obstruction in any part of the urinary tract, plays an important predisposing part in these infections. The kidney seems to possess the property of excreting bacilli from the blood stream, but infection in the urinary tract itself does not necessarily follow unless it is in an abnormal or unhealthy condition owing to stasis. In young babies with intractable pyuria the existence of some congenital abnormality of the kidneys or ureters (double ureter, megalo-ureter, or hydro-nephrosis) should be suspected, and this possibility explored by means of pyelographic investigations. In older children a persistent or recurrent Coli infection of the urinary tract is more often than not associated with an unhealthy condition of the mucous membrane of the bowel.

Treatment. Apart from the discovery of the underlying cause and its appropriate treatment, the management of these cases mainly consists in washing out the urinary tract with a copious flow of urine, which should if possible be alkaline in reaction, and possess bactericidal properties. To effect these objects the child should be induced to drink freely of plain water, barley water, or orange-ade. Not less than 40 oz. of fluid should be taken in the 24 hours. The urine may be rendered alkaline by the administration of mixed potassium, sodium, magnesium, and calcium salts. This method is superior to that of giving citrate of sodium exclusively. The latter form of treatment is apt to upset the mineral balance. The combination that I employ is as follows :

Bicarbonate of Sodium . . .	gr. v. (0·3 gm.)
Citrate of Potassium	gr. v. (0·3 gm.)
Lactate of Calcium	gr. iii. (0·2 gm.)
Carbonate of Magnesium . . .	gr. v. (0·3 gm.)
Simple Syrup	½ drachm (1·8 c.c.)

Peppermint Water to make 2 drachms (7 c.c.)

Dosage : 2 drachms (7 c.c.) to be given three times a day.

Antiseptic Treatment. This should consist in giving some urinary disinfectant, such as Helmitol (Bayer), and if this drug is employed, it should be given to the extent of 2 grains (0·13 gm.), three times a day. Helmitol possesses the advantage of exercising its antiseptic properties in the presence of an alkaline urine, and therefore can be combined with the above treatment.

For infection of the urinary tract other than that of the Colon Bacillus, such for instance as infections due to the staphylococcus, streptococcus, or gonococcus, the drug Caprokol (B.D.H.) is very effective, and may be given in the form of a solution in olive

oil, and to the extent of 30 drops three times a day. Hexamine treatment, which is extremely popular in the treatment of cases of Coli infection, has the disadvantage that its antiseptic properties are interfered with by any alkaline condition of the urine, and cannot therefore be combined with the antacid treatment described above. If employed, it should be combined with the administration of acid phosphate of sodium, or, better, with ammonium chloride, both of which tend to keep the urine acid. Cystazol (Allen & Hanbury) which is a combination of hexamine and benzoic acid, is also effective, in that the Benzoic acid maintains the acidity of the urine, and thus preserves the antiseptic properties of the hexamine. Some authorities recommend the alternating acid and alkaline treatment of Coli infections. On the other hand I cannot endorse the treatment of this condition by a ketogenic dietary, which is reputed to antagonize the development of the colon bacillus in the urinary tract, by reason of the strongly acid condition of the urine to which this mode of treatment disposes.

Specific Treatment. The aim of specific treatment is to deal directly with the responsible organisms by bactericidal means, that is to say, by vaccines, or serum therapy. As far as Coli infections are concerned, I must confess that vaccine treatment has proved disappointing in my hands, but the antiseptic treatment of the bowel, which I assume is the primary source of this infection in the majority of instances, has frequently given satisfactory results. The disinfection is in my opinion best carried out by crowding out the Coli organisms by means of the lactic acid bacillus given in the form of sour milk (see page 695). The treatment of a chronic colitis by the Plombière method of high irrigation is also effective, but appendicectomy with a view to removing a possibly infected organ and source of Coli organisms, is not to be lightly undertaken. The mobilization of the defensive forces of the organism with a view to raising the resistance of the child against bacterial infections in general and to Coli infections in particular, by means of the judicious administration of vitamins, or by subcutaneous injections of Omnadin (Bayer), to the extent of 1 ampoule on three successive days is certainly worth trying ; so also is the Prontosil Treatment (page 699).

Local Treatment. In those cases in which the infection is of the ascending character, as in a primary cystitis, an injection into the bladder of 5 c.c. of a 10 per cent solution of Protosil (Parke Davis & Co.) has an excellent local antiseptic effect.

Operative Treatment. As a last resource in intractable cases of pyelo-nephritis, surgical treatment may have to be adopted. When only one kidney is affected, as proved by cystoscopy or

pyelography, complete removal of the diseased kidney and ureter has within my own personal knowledge proved very efficacious.

Albuminuria

Albuminuria is so commonly present in new-born infants that it may be almost regarded as physiological. The condition is probably due to some temporary congestion of the kidney which soon passes off. It also occurs very readily in children in febrile conditions due to influenza, gastro-enteritis, or septic conditions. The absence of blood cells, renal casts, or epithelium, should distinguish it from albuminuria due to nephritis and other inflammatory conditions of the urinary tract, although a few of these adventitious elements are occasionally found even in purely functional cases. So-called physiological, orthostatic, or lordotic albuminuria, in which albumen mainly of the globulin variety appears in the urine of hypotonic children a short time after assuming the upright position after periods of rest, is not of serious import, and is possibly due to mechanical causes interfering temporarily with the circulation through the kidneys.

Treatment. The treatment of albuminuria, apart from that due to organic diseases, consists in attention to the general health, by the correction of lordosis or other orthopædic defects, by massage, exercise, and gymnastics. If the urine is strongly acid alkalies may be administered.

Hæmaturia

Blood in the urine of infants and young children can often be detected by naked-eye examination, but it must not be mistaken for a red coloration of the urine due to urinary pigments which often stain the infant's napkins a definite pink. In all cases of suspicion the diagnosis should be confirmed by means of microscopic or spectroscopic examination. The commonest causes of hæmaturia in infants and young children are scurvy, purpura, gravel, and ulceration of the meatus, which causes adhesion of the mucous surfaces, and a certain degree of laceration when they are forcibly separated in the act of micturition. Poisons such as turpentine, cantharides, and carbolic acid, are occasional causes of hæmaturia, even in children.

Treatment. The treatment is that of the underlying cause.

Hæmoglobinuria

The commonest causes of this condition are:

1. Winkel's disease, which is a septic condition arising in the new-born.

2. Toxic conditions, due to poisons such as chlorate of potash, or the result of large superficial burns.

3. Paroxysmal hæmoglobinuria, which is a rare condition, apparently due to the activation by cold of a definite hæmolysin in the blood plasm.

Treatment. The treatment of all these conditions must be directed to the cause.

Alkaptonuria, Porphyrinuria, and Cystinuria

All these rare conditions are usually included in the group of "in-born defects of metabolism." They might equally well be classified with acidosis and alkalosis as abnormalities of the blood plasma, since their ultimate excretion in the urine, and the symptoms to which they give rise, are due to the presence in the blood of the products of these abnormal types of metabolism, and are probably formed there. On the other hand, as their names imply, they may well be included among abnormalities of the urine. Such cases are however of such rare occurrence, and so entirely outside the range of effective treatment, that further mention of them here is unnecessary, and the reader is referred to Sir Archibald Garrod's account of the diseases and defects of metabolism in Garrod, Batten, Thursfield and Paterson's text-book on the diseases of children (page 583 *et sequentes*, 3rd edition).

CHAPTER XII

THE ENDOCRINE SYSTEM

DISEASES OF THE THYROID GLAND

In order to understand the significance of symptoms due to disturbed thyroid function, it is necessary to study the physiology of this gland under normal conditions of health. Although it cannot be claimed that we have any very complete knowledge of the subject, nevertheless, we know more about the physiology of this particular member of the endocrine group than of any other. We know, for instance, that the internal secretion of the thyroid acts as a stimulus to the sympathetic nervous system, and that when under conditions of bodily stress, or metabolic strain, abnormal calls are made on the sympathetic system, there is an increased output of thyroid hormones. Thus under such conditions as puberty, pregnancy, lactation, menopause, infectious disease, or emotional or nervous disturbance, all of which make special demands on the sympathetic nervous system, the increased functional activity of the gland is shown objectively by its vascular engorgement, and increase in size.

The physiology, and indeed the pathology of this gland is however further complicated by the intimate associations and interactions between it and other members of the endocrine group. For instance, it is almost certain that one of the internal secretions of the anterior lobe of the pituitary gland has a stimulating influence on the metabolism of the thyroid, and also that one of the adrenal hormones has on the contrary an inhibitory effect. Any attempt therefore to unravel the tangled problem of thyroid dysfunction must take into consideration the possible complication of many other endocrine reactions.

A good deal has recently been learned about the chemistry of the thyroid secretion; for instance, we know that one of the chief components is thyroxin, an iodine-containing body, the formula of which is known, and which can be prepared synthetically, and which possesses therapeutic properties when injected into the system, similar to those of thyroid secretion when taken by the mouth.

When demands are made on the thyroid gland for its specific secretion, which are in excess of its capacity to supply, either by reason of a shortage of its essential component iodine, or for any other reason, such as inherent functional inefficiency, the gland undergoes compensatory enlargement, which in extreme cases assumes the dimensions of a goitre.

The main symptoms associated with thyroid dysfunction are those which result from an excessive or deficient secretion, and each of these groups of symptoms will be dealt with separately in the following sections. It is true there are certain other diseases and anomalies of the thyroid, such as inflammation and developmental defects, but these are so rare and treatment is of so little avail, that they need not be mentioned here.

Hyperthyroidism

This condition, like that of hypothyroidism, is greatly subject to hereditary and congenital influences. Both these forms of dysfunction have a tendency to run in certain families, or at any rate to affect in common, mother and fœtus. Symptoms of minor degrees of hyperthyroidism take the form of a tendency under slight provocation to show increased pulse-rate, a raised temperature, diarrhœa, vomiting, increased basal metabolism, loss of weight, increased appetite, nervous restlessness, and excitability.

The treatment for this condition, both prophylactic and remedial, should follow the lines advised for the more advanced condition of goitre.

Goitre

Simple goitre may take an endemic form, such as occurs in this country in Derbyshire and Gloucestershire, and in other parts of the world, namely, New Zealand and Switzerland, where there is a deficiency of iodine in the soil, or it may occur sporadically without any such definite etiological explanation. In the latter case the possibility of a contaminated water supply must be considered, as also may other possible sources of chronic infection, such as diseased tonsils, or carious teeth. The two main etiological factors are however a deficiency of iodine and contaminated water. Contributory factors which must not be lost sight of are fright, and other severe nervous strains. It must be remembered in connection with the symptomology of goitre that though at first there may be excessive secretion with symptoms of hyperthyroidism, this stage may be succeeded by a condition of hypothyroidism, owing to exhaustion or atrophy of the over-

worked gland, or indeed the two contrasting conditions of hyperthyroidism and hypothyroidism may alternate.

Treatment. *Prophylactic.* The prophylactic treatment of goitre rests on the results of an inquiry into the possibility of iodine starvation, or contamination of the water supply. Foci of infection within the body, or external sources of infection, must be sought for, and if found, appropriately dealt with.

The prophylactic treatment in cases of iodine starvation from telluric or other causes, consists in the routine administration of iodized salt, and this treatment should be extended to all expectant mothers, or women of child-bearing age living in goitrous districts.

Curative. During the early stages of simple goitre, iodine treatment in the form of Lugol's solution 1–5 minims daily, is often of considerable value. Some authorities think that in place of this, or other inorganic preparations of iodine, it is better to give the organic preparation—di-iodo-tyrosin (Roche), in daily doses of 0·05 gm. or half a tablet. Later on, should symptoms of hypothyroidism supervene, this line of treatment should be changed for thyroid therapy, in accordance with the directions given in the section on the treatment of cretinism (page 361). In the case of infants at the breast, treatment may be administered through the mother. For further particulars of the general treatment of the condition, see recommendations given under "Exophthalmic Goitre."

Exophthalmic Goitre (Graves' Disease)

This severe type of goitre may be of the same nature as simple goitre, but major in degree. On the other hand it may be due to some qualitative change in the character of the secretion as well as to an increase in quantity. In exophthalmic goitre there seems to be an excessive secretion, which is brought about by some special condition, or conditions, which do not exist in the case of simple goitre. The excessive secretion has been described as a sort of paralytic secretion or "diarrhœa" of the thyroid gland. The characteristic symptom of exophthalmic goitre, namely, the protrusion of the eyeballs, is due to excessive stimulation by the thyroid secretion of the smooth muscular fibres of the capsule of Tenon, through its sympathetic nervous connections.

Treatment. *Prophylactic.* This is exactly the same as that described for simple goitre. It is however seldom that it can be applied, as opportunities for anticipating the development of the specific symptoms rarely arise.

Curative. The remedial treatment of Graves' disease in infants and children presents a very difficult and serious problem,

but fortunately in young children a rare one. The seriousness of the situation is caused by the difficulty of deciding in any particular case whether surgical interference is, or is not justified. If medical measures and the symptoms show no signs of mitigation, the only alternative is the removal of whole or part of the gland. Medical treatment consists in giving the child as complete physical and mental rest as the circumstances allow. All possible foci or sources of infection, especially of intestinal origin, must be sought for and if found appropriately treated. Intestinal toxæmia should be treated as described on page 223, with special reference to a restriction of protein foods.

The specific treatment of the disease with iodine is not always successful, and should not be undertaken as a routine measure. It is best applied in the form of di-iodo-tyrosin (Roche), and may be given to the extent of 1 grain (0·05 gm.)—*i.e.* half a tablet daily. If it does not give satisfactory results after 1 month's trial, it should be given up.

Other measures that have been tried include the following: pituitrin to control the rapid pulse-rate; adrenalin and insulin in the hope of adjusting other endocrine defects complicating the general problem; vitamin A given on the assumption that in Graves' disease the liver has a reduced power to store carotene and transform it into vitamin A, and liver preparations have also been employed with the same object in view. None of these measures should, however, be resorted to except under expert advice.

Finally, deep X-ray therapy may be applied directly to the gland, but only under the supervision of an expert, and with due regard to the fact that the parathyroids may be damaged in the process.

If finally after failure of all medical measures, surgical interference is decided upon, it should be preceded with a short course of specific iodine treatment as described above.

Hypothyroidism

(Cretinism, Myxœdema)

Various degrees of hypothyroidism are met with in babies and young children, from the major condition of cretinism with imbecility or mental defect, to minor degrees of mental and physical lethargy, which are difficult to diagnose and in which the thyroid defect is likely to be overlooked. With slowness of pulse, low temperature, constipation, retarded growth, arrested development, and a somewhat earthy tint in the complexion, and more particularly when there is a lowering of basal metabolism,

it may be confidently assumed that a condition of hypothyroidism exists. But even in the case of quite young babies, some degree of hypothyroidism may be suspected when without adequate cause or reason a baby shows general feebleness, failure to gain, combined with a low temperature, and under such conditions thyroid medication is well justified.

I have for many years made a practice of giving small doses of thyroid to all premature, immature, and congenitally feeble babies, on the ground that thyroid medication will quicken up their metabolic processes and afford them a better chance of survival. The results have been most satisfactory, and have well justified the theoretical expectations.

In the etiology of cretinism, heredity and congenital conditions definitely play some part. In goitrous districts cretinism in the offspring is often combined with goitre in the mother, and with other thyroid disturbances in other members of the same family. But these instances of familial and regional distribution are unknown in this country, and are becoming rarer and rarer in recognized goitrous districts in Switzerland and New Zealand, as prophylactic measures are becoming more generally adopted. In the endemic form of the disease, the thyroid gland is often enlarged, though functionally inefficient, whereas in the sporadic cases which we meet with in this country, the gland is almost invariably atrophied or wholly absent. In the sporadic cases the symptoms of cretinism are usually unobtrusive or absent, until the baby is a few months old, although perhaps minor symptoms of hypothyroidism as above described may arouse suspicion in the mind of an experienced observer.

In mongolism, which is sometimes mistaken for cretinism, the characteristic physical defects are present at the time of birth, and by this means may be distinguished from those of cretinism which develop later.

Whereas the cause of endemic cretinism is clearly associated with telluric conditions and lack of iodine in the soil, this explanation does not hold in the case of sporadic cases, and we have to search for some other etiological factor. Dr. R. S. Frew has suggested that a hæmorrhage into the substance of the gland, at, or soon after the time of birth, may explain the atrophy and subsequent loss of function of the gland, but a germinal defect would offer an equally good explanation of the condition.

Treatment. *Prophylactic.* As we do not meet with endemic cases of goitre in this country, we need not be concerned with measures appropriate for its prevention.

As regards sporadic cases, since there are no means known by

which we can anticipate their occurrence, there are no rational indications for prophylactic treatment. All that we can say is that since in cases of sporadic cretinism the definite and diagnostic symptoms which develop when the infant is a few months old are themselves generally preceded by some of the symptoms which we have above described as suggestive of hypothyroidism ; if any such symptoms should appear, they are indications for the immediate application of the specific curative methods described below, without waiting for the development of their pathognomonic symptoms.

Curative. The specific treatment of cretinism by thyroid medication is perhaps the most satisfactory example of endocrine therapy. If the treatment is commenced sufficiently early before the blighting influence of athyroidism has inflicted permanent injury on the development of the central nervous system and other organs, complete recovery may be looked for, but the treatment must be continued indefinitely, perhaps with occasional intermissions, throughout the entire life of the individual so affected. The simplest and most efficient method of treatment is to administer the thyroid extract by the mouth in the form of Thyroideum Siccum as standardized by Burroughs Wellcome & Co. in their tabloids, or by Parke Davis & Co. in their tablets. I do not think any advantages are conferred by the substitution of the synthetic preparation Thyroxin (Roche) for the natural product. Thyroid in the tabloid or tablet form can be stored indefinitely and in large quantities without deterioration. The dosage should be carefully supervised throughout life, but at the commencement of treatment this is particularly important. It should be commenced at a low level and only gradually increased up to the point at which the optimum degree of progress is provided, without the development of any obvious symptoms of hyperthyroidism. The initial dose for an infant 1 year of age should not be more than ½ grain daily in a single or in divided doses, and proportionately less for infants of younger age. The final dose which can be settled empirically, should not be more than 2–3 grains daily.

DISEASES OF THE PARATHYROID GLANDS

Functions of the Glands

The functions of the parathyroid glands, of which there are generally four in number in close anatomical association with the thyroid gland, are mainly to take a share in the regulation

of the amount of calcium and probably of the phosphorus, in the blood plasma. These glands play no part either in the absorption or in the excretion of calcium. Their functions apparently depend on the action of the hormone secreted by the glands, namely, parathormone, which exercises its specific action in virtue of a capacity to mobilize calcium stored in bone, and discharge it into the blood. Two complementary series of symptoms arising in connection with functional disturbance of these glands depend respectively on increased and on decreased secretion, conditions which are respectively known as hyper-parathyroidism and hypo-parathyroidism.

The regulation of calcium metabolism by the parathyroid glands is closely associated with the interplay of other partners in the endocrine mechanism, especially with the secretions elaborated by the pituitary, the gonads, adrenals, and possibly also the pancreas.

Although the parathyroid glands are largely responsible for the control of calcium metabolism, many other independent factors are concerned in this process, for instance, the amount of calcium absorbed in the food, and the amount of calcium excreted in the fæces in combination with fatty acids : these events must necessarily influence the ultimate calcium concentration in the blood.

Hyper-parathyroidism

The symptoms connected with an excessive secretion of the parathyroid glands consist in a general softening of the bones, due to the increased mobilization of calcium from these reserves, and its discharge into the blood. The pathological changes effected in bone by these disturbances of parathyroid function may take the form of osteomalacia, osteitis fibrosa (von Recklinghausen's disease), so-called " marble bone " disease, or spontaneous fractures, while changes in other tissues result in hypo-tonicity of the muscles, polydipsia, polyuria, vomiting, muscular cramps, calcification of the kidneys, wasting, and loss of strength. The blood calcium is greatly increased, and may reach the level of 12–23 mg. per 100 c.c. of blood plasma, while the phosphorus content may be as low as 1–2 mg. per 100 c.c. of blood.

All the causes of hyper-parathyroidism are not definitely known, but one is certainly associated with excessive stimulation of the glands by a hormone supplied by the anterior lobe of the pituitary. Others are connected with adenomatous growths in the parathyroid glands, and with over-dosing with parathormone, or other parathyroid extracts.

Treatment. It is fortunate that no case of hyper-parathyroidism has been recorded in a child under 10 years of age, for there is no known treatment for this condition except the surgical removal of one or all of the parathyroid glands which are the seat of adenomatous growth, or are otherwise diseased. Such operation may be followed by a swing of the pendulum in the opposite direction, and result in a condition of hypo-parathyroidism, which must receive its appropriate treatment "*vide infra.*"

Hypo-parathyroidism

The symptoms associated with a sub-normal output of parathyroid secretion are mainly the same as those of a low blood calcium, in other words, of spasmophilia. They may take the form of tetany, laryngospasm, Chvostek's sign, Trousseau's sign, Erb's sign, the perineal sign, or give other evidences of raised nervous excitability. Atrophic disturbances of the skin or its appendages, such as the nails or hair, occasionally occur. Some years ago a colleague of mine at The Infants Hospital pointed out the frequent association in wasting infants of weak and weedy eyebrows with parathyroid defect, and the remarkable improvement which might be expected in the general nutrition of such infants if they were treated with parathormone injections. Since then I have regarded the condition of the eyebrows, which are generally of a light sandy colour, in infants suffering from marasmic conditions, as an indication for parathyroid medication, and I have been gratified with the improvement in their general condition which usually takes place as the result of this treatment.

Cataract also appears to be a rare manifestation of the hypo-parathyroid state. The treatment is the same as that for tetany, "*vide infra.*"

Tetany

(Parathyroid Tetany)

This condition is usually regarded as a distinct disease entity (see also page 327). It is however only one of the manifestations of the spasmophilic state. It may obviously arise from a variety of conditions which unfavourably affect the intake, absorption, metabolism, or output of calcium. The main causes are the same as those concerned in the production of rickets, namely, those which interfere with the absorption of calcium and its disposal in bone. It is therefore mostly connected with a deficient supply of vitamin D. It may also occur as a consequence of the

surgical removal of the thyroid, an operation in which the parathyroid glands are accidentally excised at the same time.

Possible causes of a reduced calcium blood content are hyperventilation, as for instance in whooping-cough, excessive vomiting as in pyloric spasm, or by over-dosing with bicarbonate of soda or phosphates. It also occasionally occurs in nephrosis, and cœliac disease.

The symptoms of tetany are those of spasmophilia (see pages 107, 555 and 559), and require no further mention here.

Treatment. *Prophylactic.* The measures which are calculated to prevent rickets are also prophylactic for tetany, and for this reason the early administration of vitamin D, or the fraction of irradiated ergosterol which is known as A.T.10. is advocated. This fraction does not contain vitamin D, but has the effect of raising the calcium content of the blood. Its action is slow but prolonged, but it must be given with caution as it may produce calcification of the kidneys.

Curative. Cow's milk is usually interdicted during the acute phases of tetany, on the ground that the copious soap stools which usually characterize this method of feeding deplete the body of too large a part of the ingested calcium. If however sufficient calcium is otherwise provided, this objection does not stand. If cow's milk is modified to the standard of breast milk, as far as its affect on the blood calcium is concerned, the artificial method of feeding is just as safe as the natural one. As a rule, however, tetany occurs at an age when a mixed diet has been substituted for milk, and in such cases it should consist of a sufficiency of calcium-containing foods. The food should also be correctly balanced and fulfil all the conditions of physiological feeding.

Apart from diet, the general treatment must be directed to the restoration of the calcium balance in the blood. This consists in supplying a sufficiency of calcium salts, such as the lactate, chloride, acetate, or gluconate (Sandos), or indirectly by the administration of ammonium chloride to correct any concomitant condition of alkalosis. At the same time a sufficiency of vitamin D in one of its many forms should be administered.

The actual details of treatment are as follows: For the immediate relief of such acute symptoms as general convulsions, carpo-pedal contractions, laryngospasm, etc., it may be necessary at first to give an anti-spasmodic, such as chloral, to the extent of 2 gr. by the mouth or morphia 1/100th gr. hypodermically, both of which may be repeated if they seem to have a good effect, or they may be given in combination. With general convulsions

of a serious nature, the giving of a whiff of chloroform may have a most salutary effect, and is usually justified by the result. Calcium medication should take the form of 10 grains of calcium lactate, or more, given three times in the 24 hours. In my experience phosphorized cod-liver oil (see page 699) has almost a specific action on tetany. I have been in the habit of giving 1 teaspoonful of cod-liver oil, three times in the 24 hours in which phosphorus (1 part in 4000) has been dissolved. Personally, I do not recommend the administration of parathormone or any other extract of the gland, but if it is given, it must be given hypodermically, and not by the mouth, and in quantities amounting to 15–20 units daily.

DISEASES OF THE THYMUS

Although opinion is constantly changing, it seems at the present time to be generally acknowledged that the thymus must be included in the hierarchy of endocrine glands. Its precise functions are however less clear, although there are reasons for believing that they are in some way associated with the activity of the sex glands, and with growth. When enlarged, the gland may interfere mechanically with respiration, and give rise to a condition of status lymphaticus, which together with a tendency to syncopal attacks, or the possibility of sudden death on very slight mechanical or mental provocation, make up the greater part of the symptom complex associated with disturbed functions of this gland.

Thymic Asthma

This may be, and probably is, due to mechanical pressure on the trachea, or on the vagus. On the other hand, it may possibly be referable to the action of a thymic hormone stimulating the vagus. Thymic asthma may take the form of brief paroxysms of dyspnœa, with noisy breathing, cyanosis, and retraction of the ribs. The attacks may however last for several days, or even weeks. Sometimes they bear a resemblance to petit mal, and in this variety of attack the child holds its breath, becomes cyanosed, falls to the ground, and occasionally loses consciousness, sometimes for as long as several hours.

Treatment. The treatment for this condition is the same as that given below for status-thymico-lymphaticus. The remedies employed for ordinary asthma are quite useless in thymic cases. The surgical removal of the whole or part of the gland is a major operation of great difficulty, and attended with serious dangers,

and should not be attempted in view of the fact that a definite involution of the gland can be brought about by the skilled application of X-rays.

Status Lymphaticus

(Status-thymico-lymphaticus)

As in the case of thymic asthma, the gland is always enlarged. There is hypoplasia of the aorta, and large vessels, combined with enlargement of the whole of the lymphatic system including spleen, tonsils, adenoids, Peyer's patches, etc. Children suffering from this condition are fat, anæmic, and show a special liability to sudden death from physical or mental shock.

Treatment. *Prophylactic.* When there is known to be, or suspected to be, a condition of status lymphaticus, the greatest care should be taken in avoiding all possible sources of physical or mental shock, and the child should be treated on the general lines indicated below.

Curative. It has been claimed that diet considerably influences the size of the thymus. What is quite certain is that in starvation it becomes smaller, and with over-feeding it becomes larger. A simple diet of fruit, vegetables, lean meat, and skim milk, is to be recommended, also with strict limitation as regards quantity. Iron and arsenic may be given to counteract the tendency to anæmia, while the application of X-rays over the upper part of the sternum in four weekly administrations has been reported on as giving excellent results. In almost all cases there is a tendency for spontaneous involution as the child grows older, especially after puberty.

DISEASES OF THE ADRENAL GLANDS

Normal Functions. The adrenal gland consists of two parts —the cortex, and the medulla. Each of these has a different function, dependent on the distinctive physiological properties of the two hormones secreted by the two respectively. While the medulla secretes the hormone adrenalin, the chemical and physiological properties of which are well known, the cortical part secretes a hormone to which the name cortin has recently been given. Very little is known about the properties of the latter hormone. The medullary part of the gland contains in addition to the chromaffine cells which secrete the adrenalin, a number of other cells which must be regarded as a specialized ganglionic nerve centre.

The Properties of Adrenalin. Adrenalin is the eclectic stimulant of the sympathetic nervous system, and can either excite or inhibit the various organic functions of the body in accordance with the special forms of nervous control exercised by the sympathetic system upon the organ concerned; for instance, it inhibits peristalsis of the stomach, and intestines, while it stimulates the muscles of the pylorus and ileo-cæcal sphincters. It relaxes the muscles of the small bronchi, and thus relieves asthma, while it stimulates the dilator iridis muscle and thus induces mydriasis. Probably its most important function is to stimulate and maintain the tone of the unstriped musculature of the vaso-motor system and thus raise or maintain blood pressure. It also has a marked influence on carbohydrate metabolism, in that it mobilizes sugar in the blood and produces a temporary glycosuria. It also has a tendency to raise the blood temperature by its stimulating effect on general metabolism.

Like all other hormones, it has a diphasic action—thus it first raises, and then lowers blood pressure, and in this way adds complications to the understanding of its varied functions.

Adrenalin secretion is itself influenced by a number of factors, some of which cause an increase, some a decrease of its concentration in the blood. It is increased by emotional excitement, muscular exertion, oxygen deficiency, and the administration of insulin, caffein, morphia, strychnine, etc.

Hormone of the Adrenal Cortex (Cortin). This hormone exercises a decisive influence on metabolism. When it is entirely withheld by complete removal or disease of the supra-renal bodies, death ensues quite rapidly. Two special functions have been ascribed to this hormone—(1) That of detoxicating poisonous substances, and (2) that of stimulating the development of the sex organs and secondary sexual characteristics. In pregnancy and after castration the cortex is enlarged. Bilaterally adrenalectomized animals can be restored to health even when at the point of death, and kept alive almost indefinitely, by the artificial administration of cortin, and a comparable, though not so valuable a result follows its intravenous injection in cases of Addison's disease.

Addison's Disease

This disease, although not the only one due to disturbances of the whole adrenal gland, is far the most common: it is however very rare in infancy and childhood, although symptoms of it have been described in the new-born infant. The term "Chronic adrenal insufficiency" has been applied by Packard and

Wicksler [1] to a clinical syndrome in which the outstanding features are extreme emaciation, loss of bodily fat, asthenia, anorexia, polyneuritis, trophic ulcers, and a high level of non-protein nitrogen in the blood, in fact to a condition which with the exception of pigmentation of the gland, is almost identical with Addison's disease. In Addison's disease the specific symptoms are definitely due to a morbid condition of the adrenal glands, with a corresponding insufficiency of all their secretions. A caseating tuberculosis is a common cause of adrenal failure in Addison's disease, but syphilitic tumours, and leucæmic infiltration are also occasionally causes of the symptoms. It is also possible that impairment of adrenal function may be associated with the status thymico-lymphaticus.

Although practically all the symptoms of Addison's disease are understandable on the grounds of a deficient adrenalin and cortin secretion, the characteristic pigment is not explicable on this hypothesis, and some alternative interpretation must be found for this phenomenon. It has been suggested that it may be found in connection with the interference of the storage of vitamin C in the glandular substance. It is a well-known fact that under normal conditions there is a large storage of ascorbic acid in the adrenals, which is lost in Addison's disease, and that this substance has a de-pigmenting effect on the epidermal structures.

Treatment. *Prophylactic.* There is no known means of prophylaxis against Addison's disease, apart from the fact that it is occasionally a complication of generalized tuberculosis, and that against this disease certain prophylactic measures are possible.

Curative. In every case of Addison's disease the underlying cause must be sought for, and if found, treated. Both syphilis and tuberculosis are cases in point, and if held responsible, should be treated each on its own specific lines.

Diet. The dietary of patients suffering from Addison's disease is difficult, owing to the usual complication of anorexia. Under such conditions stimulants like gentian, cardamoms, pepsin, and hydrochloric acid should be administered (see page 692) to stimulate the appetite. Iron and arsenical preparations may be given to improve the general condition.

As regards subsequent treatment, adrenalin should be given hypodermically to the extent of 2–4 minims of 1 in 1000 solution, two or three times a day, to compensate for its deficiency in the blood. With this should be combined treatment by the other

[1] *Presse Med.*, 1935, March, vol. xliii, p. 505.

adrenal hormone, namely, cortin,[1] which should also be given hypodermically, and to the extent of 2–4 c.c. This latter treatment is however very expensive. Vitamin C deficiency, which if in doubt can be confirmed by urinary examination, may be counteracted by the oral administration of ascorbic acid, 50 mg. daily, in the form of the tablets supplied by Hoffmann La Roche under the name of Redoxon. This method of supplying vitamin C is definitely preferable to giving large quantities of orange or lemon juice. The administration of ordinary table salt has been strongly recommended by Maranon and others[2] in those cases, to compensate for the usually low chloride content of the blood. The salt may be given by the mouth to the extent of 30 grains or more in the 24 hours, given in milk, or less conveniently, but possibly more effectively, by intravenous injections of a 10 per cent solution.

Diseases of the Adrenal Cortex

Although theoretically there must exist in conditions of both health and disease, variations in the quantity of hormone secreted by the adrenal cortex, with corresponding symptoms, definite symptom complexes due to purely functional disturbances in the secretion have not been described, and possibly may not be capable of diagnosis. On the other hand, tumours of the cortex leading to excessive secretion have been frequently described, and the symptoms are well known.

Tumours of the Adrenal Cortex

(Hypernephromata, Suprarenal Virilism)

Overaction of the adrenal cortex owing to the presence of tumours is liable to cause precocious development of the sex organs and secondary sexual characteristics. A child suffering from this condition may grow unusually fat, large, and strong, and the hair may grow on the pubes and chin, as well as in the axilla. The voice may be deep and gruff, and the skin become the seat of seborrhœa or acne, such as occurs at puberty. The external genitals may be of abnormal size, and the child may display symptoms of precocious sexual libido. In the early stages of the disease it may be quite impossible to distinguish by palpation or other method of physical examination the existence of a tumour in the neighbourhood of the kidney. Later on, the diagnosis may be confirmed by tumour metastases (hypernephro-

[1] A similar hormone is supplied by Parke Davis & Co., under the name of Eschatin : ½ to 1 c.c. to be injected daily for four doses.

[2] *Arch. Int. Med.*, 1934, July, vol. liv.

mata). In the case of girls there is a tendency to masculinization and the loss of the female characteristics.

Treatment. Treatment consists in the removal of the adrenal tumour if it can be diagnosed before metastases have taken place.

Diseases of the Adrenal Medulla

The signs of enhanced function of the adrenal medulla generally take the form of a marked increase in the excitability of the sympathetic nervous system, with a tendency to perspiration, vaso-motor activity, palpitations, psychical instability, restlessness, and raised blood pressure, presenting a clinical picture which somewhat closely resembles that of pre-Graves' disease. The diagnosis of such a condition is however extremely likely to be missed.

Tumours of the Adrenal Medulla

These tumours are of the nature of neuro-blastomata. They consist of embryonic undifferentiated ganglionic cells of the sympathetic type. Metastases occur readily, especially in the orbit, giving rise to proptosis and hæmorrhage into the conjunctivæ and eyelid. Secondary growth may occur, in the bones of the skull, in the lymphatic glands, in the liver, and in the medullary cavities of the long bones. In certain cases the tumour formation is confined to the abdomen, and special nodular enlargements of the liver, which may become enormous.

The diagnosis is very difficult until metastases has occurred, or the liver has become enlarged. The early symptoms have at times been mistaken both for scurvy and for rheumatism. There is however usually a history of progressive anæmia, weakness, headache, and obscure pains.

Treatment. The only possible hope for treatment lies in the removal of the primary tumour by surgical means, before metastases have occurred. The value of X-ray treatment is questionable, though temporary involution of metastatic growths has been reported.

DISEASES OF THE PITUITARY GLAND

The pituitary body has been described as the master gland of the endocrine series. Under normal conditions it influences, if it does not actually control, most of the organic functions. It regulates growth, metabolism, and the development of the sexual organs. It is concerned in the maintenance of tonus of the involuntary muscles of the intestines, uterus, and bladder, and

finally it governs the secretion of other endocrine glands, especially the gonads, thyroid, pancreatic islet system, and adrenal cortex. The following table taken from Zondek [1] gives some idea of the multiplicity of the various hormones secreted by the gland.

TABLE XIII

SURVEY OF THE HORMONES

Anterior Pituitary Lobe.	*Posterior Pituitary Lobe and Pars Intermedia.*
Growth Hormone.	Melanophore Hormone (Intermedin).
Gonadotropic Hormone (Prolan A and B).	Vasopressin.
Hormone of Metabolism.	Oxytocin.
Pancreatotropic Hormone.	
Thyrotropic Hormone.	
Corticotropic or Interrenotropic (Suprarenotropic) Hormone.	
probably also :	
Bromine Hormone.	
Parathyrotropic Hormone.	
Galactagogue Hormone (Prolactin).	

Not many of the hormones included in this table are as yet obtainable in a sufficiently pure form for therapeutic application, but as we get to know more about the individual hormones, their properties and therapeutic uses, pituitary medication will probably be placed on a more satisfactory and scientific basis. Although it is not as yet possible to sort out all the various symptoms due to pituitary dysfunction and assign them to their own particular cause, we have a very good understanding of the general clinical picture of hypopituitarism, and to a lesser degree of hyperpituitarism.

Hyperpituitarism

Gardiner Hill asserts that in the case of young children hyperpituitarism as a definite disease entity has no sound pathological basis, and that many of the cases of giant growth and obesity in young children which are ascribed to pituitary hyper-function, are in reality only instances of familial tendencies. But in adolescents and adults overaction of the anterior lobe, especially in the case of adenomata of the chromophilic cells, may give rise to definite giantism, hypertrophy of the thyroid, thymus, adrenal cortex, and perhaps precocious puberty and diabetes mellitus.

[1] ZONDEK, HERMAN, " The Diseases of the Endocrine Glands," p. 49.

All the same, it is quite possible that in young children similar symptoms in lesser degree may develop, but Gardiner Hill warns us against explaining all cases of giant growth and obesity in children on a pituitary basis.

Treatment. The treatment of this condition has very seldom to be considered in the case of children, but it may be stated definitely that the indiscriminate treatment of cases of obesity on pituitary lines, unless a very trustworthy diagnosis has been made of the cause, is not likely to meet with success.

In adults, X-ray treatment has occasionally been followed by good results, and remarkable cures have been effected by the surgical removal of adenomatous growths.

Hypopituitarism

Two main types of this condition are met with. One is due to destruction of the gland, and mainly its anterior lobe, by intrinsic disease, generally taking the form of ischæmic necrosis secondary to infarction. The second type is due to extrinsic disease, generally a cerebral tumour in the neighbourhood of the Sella tursica, which compresses the gland and induces secondary atrophy. This condition causes a double set of symptoms, one glandular and the other cerebral. The cerebral symptoms include headache, papillœdema, and later mental disturbances and cachexia. This type of case was first described by Simmonds, and it is now generally known by his name.

The symptoms which are due to the hypo-function of the gland itself consist of dwarfism, infantilism, and skeletal disproportion, in which the long bones are relatively short as compared with the trunk. There is also obesity of the female distribution type, hypoplasia of the external and internal genitals, and absence of other secondary sexual characteristics. The skin is dry and the head covered with an abundance of fine hair.

Treatment. Treatment is unsatisfactory, and should only be undertaken by an endocrinologist. Subcutaneous injections of pituitrin or antuitrin (20 rat units), insulin 2–5 units, daily, in cases complicated with diabetes, has occasionally given good results.

Insufficiency of the Posterior Lobe

Little is known of the pathology of insufficiency of this part of the gland, but it is believed to dispose to a high carbohydrate tolerance, obesity, dizziness, polyuria, and inhibition of sexual development, in fact to symptoms which are very much the same as those described in Frohlich's syndrome.

THE GONADS

Abnormalities of development of the sex organs and of the secondary sexual characteristics are not altogether unknown in young children, although the whole subject naturally assumes greater importance at or after puberty. Abnormalities may take the form of under-development (hypo-gonadism), or of over-development (hyper-gonadism). The hormones concerned in the maintenance and disturbance of function in these organs are :

1. The undifferentiated gonadotropic hormone of the anterior part of the pituitary gland (Prolan).
2. The follicular hormone (Œstrin).
3. The corpus luteum hormone (Progestin).
4. The male sex hormones.

Since the identification of these specific principles, the understanding of sex gland disorders has been placed upon a much surer foundation.

Hypo-gonadism (Eunuchoidism)

This condition is comparatively common in male children, but rare in females. Male children are inclined to become fat, and assume the female type. The external genitals and testicles are small.

Treatment. Males can be treated by the grafting of testicular tissue in the scrotum at the time of puberty, but cryptorchidism and hypogenitalism in males can be treated during early childhood by Antuitrin "S," or Prolan, and success has been claimed for the treatment.

Females can be treated by the follicular hormone (œstrin), and by progestin, the hormone of the corpus luteum. In the case of both males and females thyroid therapeusis can be combined with the specific hormone, but the whole matter of the treatment of these cases is still so much in the experimental stage that it would be unwise for anybody other than a trained endocrinologist to undertake it.

Hyper-gonadism

The subject of hyper-genitalism and precocious puberty has already been referred to in the sections dealing with the adrenal and pineal glands (pages 369 and 374 respectively).

In certain cases, however, the condition is due to primary disturbances of the testicular or ovarian functions by tumours. This condition is generally accompanied by hypertrophy of the

external genitals and precocious development of the secondary sexual characteristics, evidenced by hypertrichosis, premature development of the muscular and osseus systems, followed by early union of the epiphyses, and cessation of growth. The striking characteristic of the condition is the great enlargement of the carpal and tarsal bones. There is also a general tendency to obesity, and retardation of mental development.

Treatment. The only hope for successful treatment lies in the application of surgical treatment and the removal of tumours if such are responsible for the precocious development. The success of X-ray treatment is questionable, but hypertrichosis in females has been treated successfully by œstrin.

PINEAL GLAND

Little is known about the physiology of this gland. It is believed however to secrete a hormone which has an inhibitory influence on the development and activity of the sex glands. Tumours of this gland, generally teratomata, cause precocious puberty, and over-development of the genitalia and of the secondary sexual characteristics, accompanied often by somnolence. One case has been recorded in which a boy, normal up to the age of 10 years, ceased to develop sexually after this age. At the autopsy no pineal body was found, a fact which was considered sufficient to explain the abnormality of development.

Treatment. None.

THE PANCREAS

Internal Secretion (Insulin)

Although the pancreas by reason of its extraneous secretion must be included among the organs of digestion, nevertheless, in virtue of its endogenous hormone (insulin), it is also entitled to rank among the members of the endocrine series, and for this reason the results of disturbances of its internal secretory function will be included in this section.

The function of the internal pancreatic secretion, insulin, is to regulate carbohydrate metabolism, which may be favourably or adversely influenced according as the secretion is normal, excessive, or deficient in amount. The common defect is a deficiency of the secretion which leads to a condition of hyperglycemia, diabetes, or glycosuria.

Hyperglycæmia (Diabetes Mellitus)

Interference with the functions of the islets of Langerhans results in a total or partial suspension of the specific secretion of these cells, and gives rise to a condition of diabetes. Such interference may be due to various causes, central, glandular, or peripheral, of which the following are examples :

1. Interruption of the normal nervous control by the autonomic nervous system owing to emotional or nervous strain (neurogenous diabetes).
2. Disturbance of the endocrine balance, such as hyperthyroidism, or pituitary or adrenal excess.
3. Acute infections.
4. Excessive demands on the carbohydrate metabolism, by over-feeding with sugar.
5. Familial tendencies, congenital defects in the islet system, or refractoriness to insulin from unknown causes.

Transient glycosuria is a very common symptom in babies and young children, and is not as a rule of serious import so long as it is due to a temporary and preventible cause, such as excessive ingestion of carbohydrate food, or infectious disorders.

Genuine diabetes is however a very serious condition in young children, but fortunately of rare occurrence. Before the discovery of insulin it was almost invariably fatal in children under 5 years of age. Now, however, with effective and continuous insulin treatment life may be almost indefinitely prolonged.

Treatment. *Prophylactic.* Preventive treatment consists in keeping a careful watch in the case of children who may have familial predispositions to diabetes or obesity, for symptoms of glycosuria, and in avoiding all those causes which as enumerated above are liable to produce a temporary appearance of sugar in the urine. In cases in which a definite diagnosis of glycosuria can be made, specific treatment must be commenced at the earliest possible moment.

Curative. In all cases in which it is at all possible, the patient should be admitted to a hospital or nursing home for observation purposes, so that the effects of diet and drug treatment may be watched, and the child habituated to the artificial life and routine imposed by the diabetic condition. During this preliminary period, which should extend to some 2 or 3 weeks, opportunity should be taken to instruct the mother or nurse in the details of management, in the testing of the urine, in the provision of suitable dietaries, and in the giving of the injections. The psychological management is also of importance, all nervous excite-

ment, and emotional disturbances should be avoided as far as possible.

Exercise. The exercise taken by juvenile diabetics requires regulation. Such children are certainly better not confined to bed unless any concomitant complication renders this necessary, but exercise should not be indulged in to the point of fatigue.

Clothing. With insulin treatment children do not as a rule suffer from cold, and over-clothing should be avoided, as it tends to restrict metabolism. Cellular underclothing has its advantages, especially if there is any tendency to free perspiration.

Dietary. The principles which must be observed in the dieting of juvenile diabetics are practically the same as those which apply in the case of adults, and do not differ very materially from those which should be observed under normal circumstances for children of the same age. The caloric requirements per pound of body-weight are more than that which is required for adults, and slightly less than is usually prescribed for normal children. At 1 year of age the caloric requirement is about 40 Calories per pound of body-weight, and at 5 years about 35 Calories per pound of body-weight. In the accompanying Table the figures are given more precisely.

TABLE XIV

TABLE OF CALORIC REQUIREMENTS FOR DIABETIC CHILDREN

Age.	Average Weight in lb.	Calories per lb. Body-weight.	No. of Calories required in the 24 hours.
1 year	21	40	840
2 years	28	37	1,036
3 ,, ...	32	35	1,120
4 ,, ...	38	35	1,330
5 ,, ...	40	35	1,400

Balance. Before the introduction of insulin, diabetic patients of all ages were greatly restricted with respect to diet, and more especially as regards the carbohydrate allowance, which was severely cut down. Fats were usually allowed in compensatory quantities, as also were protein foods. The consequence of this was that diabetic patients were very liable to suffer from intestinal toxæmia, due to protein excess and decompositions in the bowel, and to acidosis and ketosis from excess of fats. To-day, under insulin treatment, the tendency is to keep down the fats and the proteins and to allow a far more liberal allowance

of carbohydrates. The balance that is usually enjoined is in the following ratio—

Carbohydrate 10 :
Protein 7 :
Fat 8.

This, as compared to the balance usually advised for infants, shows a slight excess as regards fat, and a considerable shortage as regards the carbohydrate. It will be noticed that this balance of 10, 7, 8, is not very far short of a balance of 1, 1, 1, which is the balance of ordinary cow's milk, and therefore in arranging the balance for an artificially fed infant subsisting exclusively on a milk diet, the milk requires no modification, and may be given whole, or if greater accuracy is required, a small additional ration of carbohydrate may be provided.

In the case of older children who have passed the bottle stage, the arrangement of balance so as to conform to the above ratio is comparatively simple, provided that the percentage composition of the chief foods which make up the dietary is known. In Table XV a sample diet is provided which gives a total of 1,220 Calories in the 24 hours, which is sufficient for a child between 3 and 4 years of age. In this Table the balance of carbohydrate 10, protein 7, and fat 8, is accurately maintained. In order that variations may be introduced into the child's dietary without disturbing the balance or caloric value, Table XVI is provided giving the percentage composition and Calorie value of some of the more common articles of diet used in the feeding of young children.

It will be observed that the diet shown in Table XV is not a very strict one as regards the carbohydrate allowance, and the fat is rather less than is generally given. It contains, however, a good representation of both vitamins and mineral elements. If with an average number of units of insulin the urine cannot be kept moderately free of sugar, the carbohydrate allowance must be cut down and the fats increased.

The above dietary will be found satisfactory for the majority of children, but foods of low nutritive value, and good roughage quality, such as green vegetables, salads, fruits, bananas, etc., may be given in larger quantity than is allowed for in Table XV if thought desirable, without greatly increasing the caloric value, or disturbing the general balance. It must be remembered in dieting diabetic children that the latter require a full allowance of the accessory factors such as the mineral elements and the vitamins, and to fulfil these requirements it will be found useful

TABLE XV

DIET FOR A DIABETIC CHILD BETWEEN 2 AND 3 YEARS OF AGE

	Calories.
On Waking :	
The juice of one orange	12
Breakfast :	
Milk, 8 oz. (160 Cals.) Bread, dry biscuit, oatcake, etc., 1 oz. (64 Cals.) Butter, ¼ oz. (52 Cals.) Dry cereal, ½ oz. ; Bemax, ¼ oz. (84 Cals.) Stewed fruit or baked apple, 2 oz., sweetened with saccharin (30 Cals.)	390
11 *o'clock :*	
A cup of bone and vegetable broth (page 708), uncleared of marrow-fat (30 Cals.) An apple (24 Cals.), banana (60 Cals.) or other raw fruit, 2 oz. (40 Cals.)	31 (Average)
Dinner :	
Meat, 2 oz. (120 Cals.) or Fish, 3 oz. (90 Cals.) or one egg (120 Cals.) Green vegetables *ad lib.* (30 Cals.) Potato, 1 oz. (25 Cals.) Bread, 1 oz. (64 Cals.) Butter, ¼ oz. (50 Cals.) Stewed fruit, 2 oz. (40 cals.) Boiled custard, 2 oz. (60 Cals.)	367
Tea :	
Milk, 8 oz. (160 Cals.) Bread, biscuit, rusk, etc., 2 oz. (120 Cals.) Butter, ½ oz. (100 Cals.) Jam, ½ oz. (30 Cals.). Marmite, 1 drachm, or other flavouring condiment (3 Cals.). Lettuce, water-cress, *ad lib.* (10 Cals.)	390
Supper :	
Cup of Broth, uncleared of fat (average number of Cals., 30)	30
	1,220

to give these independently in the form of concentrates. Vitamins A and D may be effectively given in the form of Adexolin ; vitamin B in the form of Marmite, or Bemax ; vitamin C as ascorbic acid (Redoxon) ; and the minerals in the form of a combination of salts, known as " Nutritive Salts " (Parke Davis & Co.) prepared according to the formula (page 696).

Drug Treatment. The drug treatment of genuine diabetics, apart from complications, which will be dealt with later, may be dismissed almost in one word—insulin. But the amount to be

TABLE XVI

THE CALORIE VALUES AND PERCENTAGE COMPOSITIONS OF CERTAIN COMMON FOODS GIVEN TO DIABETIC CHILDREN

Name of Food.	Percentage Composition.			Calorie Value per oz.
	Proteins.	Carbo-hydrate.	Fat.	
Bread	7·2	48	0·2	65
Flour	10·1	75	1·6	104
Rice	7·4	79·2	0·4	102
Tapioca	12·0	76	0·7	105
Cereals (dry)	10	75	1·6	104
Meat (average) Cooked	8	—	5	77
Fish (boiled)	6	—	1·5	35
White of Egg	10·7	—	—	14
Yolk of Egg	15	—	33·3	108
Cheese	25	—	33	121
Chicken	17·8	—	7·3	39
Apples	0·3	10	0·2	12
Bananas	1·2	12·5	0·1	30
Grapes	0·6	14	0·1	16

administered and the number of daily injections must be carefully regulated in accordance with the special conditions. The number of units of insulin to be given daily must be based on the sugar estimations of both the urine and the blood. Sufficient must be given, and at sufficiently short intervals, to keep the sugar concentration in both urine and blood at a more or less normal level. The blood sugar content should be kept at approximately 120 mg. per 100 c.c. of capillary blood in the fasting state, and at about 200 mg. per 100 c.c. after a meal. An approximate dosage of insulin should be fixed during the probationary period when the child is under observation in hospital or nursing home. As a start a preliminary dose of insulin should be fixed at about 5 units injected twice daily, half an hour before breakfast, and half an hour before tea. A more precise estimation of the initial dose of insulin to be administered in order to control the glycosuria may be taken as 1 unit of insulin for every 2 gm. of sugar excreted in the urine in 24 hours. In all cases the urine should be examined from time to time at definite intervals, both before, immediately after, and between meals, in order to fix the dosage of insulin, and to find the optimum times for injection, so as to maintain the urine in as sugar-free a condition as possible. It is however almost impossible in the majority of cases to maintain the urine in an absolutely sugar-free condition, and the risk of over-dosage is incurred in attempting to do so.

The new insoluble " Zinc Protamine Insulin " [1] is rapidly taking the place of the original soluble insulin (insulin hydrochloride in weak acid solution). This new compound is a stable and fine suspension which sediments on standing, and hence requires a thorough shaking before injection, to ensure uniformity of strength.

At present this new form of insulin is supplied in a strength of 40 units per c.c. It is so slowly absorbed from the subcutaneous tissues that its action is sustained for 20–24 hours after injection, and hence only one dose is required daily, consisting of about the same number of units as indicated in the case of the old form of insulin. Owing to its delayed action " Zinc Protamine Insulin " is not so suitable as the old insulin for emergencies, but it may safely be combined with the latter for this or general use.

Complications.

Insulin Shock. Insulin shock usually takes the form of coma, or loss of consciousness, which comes on suddenly with some degree of collapse. The skin as a rule is cold, pale, and moist, the breathing normal and shallow, the pulse full and bounding, and the sugar content of both the blood and urine is below the normal level.

Treatment. This is as a rule simple. It consists in the immediate administration, by the mouth when that is possible, of ½ oz. of glucose in hot tea, Bovril, or lemonade, with subsequent adjustments of the insulin dosage, and a revision of the dietary, which usually requires carbohydrate supplementation.

Coma. Coma may occur in cases of diabetes in which for any reason the insulin treatment has been omitted. It may also occur as a result of an infection superimposed on the diabetic condition. Infections almost invariably lead to an increase of glycosuria and of the accompanying ketosis or acidosis if such exists. Diabetic coma has to be distinguished from insulin shock, as the treatment in the two cases is so different. Diabetic coma comes on gradually with " air hunger," an odour of acetone in the breath, a pulse which is weak and rapid, and urine which is loaded with sugar, diacetic acid and other acetone bodies.

Treatment. This consists in immediate lavage, followed by free drinks of fluids containing 20–30 gr. bicarbonate of soda, to counteract the dehydration and the acidosis.

The dosage of insulin must be raised to double that which has previously been given, or if insulin has not been given, the dosage should now be between 15–40 units, which should be repeated

[1] Lawrence, R. D., and Archer, Nora. *Brit. Med. Jour.*, vol. i, 1937, p. 489.

at comparatively short intervals until all the sugar has disappeared from the urine and the acidosis and ketosis has been controlled. In more severe cases, fluid should be introduced into the system by the more direct intravenous route, and Hartmann's $\frac{1}{6}$th molar solution (page 717) should be injected intravenously to the extent of 1 oz. per lb. of body-weight. The solution may be diluted with distilled sterile water if thought desirable, or the body fluids may be reinforced by the subcutaneous injection of similar amounts of Hartmann's fluid combined with a small dose of insulin. This injection may be repeated until the urine is sugar-free.

Infections. Infections of all sorts, as for instance, catarrhal, streptococcal, pneumococcal, or those due to coli organisms may not only bring about exacerbation of symptoms and coma in balanced cases of treated diabetes, but may induce a condition of glycosuria in those previously free from symptoms. The reason for this is not clear. It may be that these infections have a toxic influence on the function of the islets of Langerhans, or the condition of acidosis to which they predispose may have an inhibiting effect on the activity of the insulin. Every precaution must be taken to protect the juvenile diabetic from possible sources of infection, and should infection occur, steps must be taken to deal with the glycosuria the moment it arises, by specific and energetic measures.

Surgical Operations. Surgical operations, especially those required for the relief of septic conditions, need not be definitely relinquished or delayed as they used to be in the pre-insulin days, but should be undertaken with boldness and despatch. The state of the blood and urine should however be carefully investigated, and if the condition warrants, the specific treatment with insulin may be pursued somewhat more energetically in view of possible exacerbations following the surgical operation. The choice of anæsthetic and possibly of anæsthetist too, is important. Gas and oxygen are as a rule safer than chloroform. After the operation is over there is always some danger of insulin shock, if the dosage has been greatly increased in anticipation of a resulting hyperglycæmia.

Local Complications owing to Repeated Injections. Owing to constantly repeated injections, the site of insertion of the needle should be changed from day to day, to prevent induration of the skin, or erythematous patches in the neighbourhood of the prick. Pain may be avoided by keeping the needles clean and bright, and by renewing them sufficiently often. It is important also to see before each injection that the needle is free from any

irritating antiseptic in which it may have been immersed. A little massage after the injection at the site of entrance of the needle also helps to avoid subsequent pain and induration of the skin.

Resistance to Insulin. Temporary refractoriness to insulin may occur from unknown causes during the course of treatment. In such cases the possible supervention of insulin shock when the period of refractoriness has passed must be borne in mind.

Hyperinsulinism (Hypoglycæmia)

Any account of the morbid phenomena connected with disturbances of insulin secretion would not be complete without some reference to those which may arise in connection with an excessive production of insulin by the pancreas, or to some hypersensitiveness of the body to normal amounts of this hormone.

Under the term " Insulin Shock " some reference has already been made to the symptoms which may arise from the artificial introduction of an excess of insulin into the blood. Very much the same results follow from the spontaneous or idiopathic increase of insulin secretion. According to some authorities, however, the immediate cause of the associated phenomena is not so much the presence of an excess of insulin in the blood, or the hypoglycæmic condition to which it conduces, as the excessive secretion of adrenalin which may have evoked it. But whether directly due to excess of insulin in the blood, or indirectly to excess of adrenalin, or to the hypoglycæmic condition, the so-called syndrome of hyperinsulinism is a genuine entity and has been very fully described by Banting, Collip, Harris, Macleod, and others.

In mild cases the characteristic symptoms are muscular weakness, aversion to work, a tendency to dizziness, often accompanied by ravenous hunger, palpitations, anxieties, tremors, irritability, and sweating. In severe cases these symptoms may be accompanied by incoherence of speech, attacks of vertigo, convulsions, vomiting, and comatose conditions. Of recent years combinations of these same symptoms developing in children of the neurotic, neurasthenic, and atonic types, have been ascribed to conditions of hypoglycæmia, arising either from unknown causes, or from a too rapid exhaustion of the sugar reserves in the blood, and have been treated indiscriminately on this assumption by the therapeutic administration of large doses of glucose, barley-sugar, and other forms of soluble carbohydrate. The popular explanation of recurring biliousness or migrainous attacks, as well as ordinary sick headaches, as due to acidosis, has also led to the popular practice of treating all such attacks, and many others

also, as if they were really due to a low sugar content of the blood, and amenable to treatment by taking large quantities of glucose by the mouth. However rational it may be to treat cases of neurasthenia, hysteria, epilepsy, migraine, etc., with glucose when the diagnosis of a hypoglycæmic state has been confirmed by laboratory tests, nothing can be more unscientific or dangerous than to assume that every case of ketosis, vertigo, vomiting, or headache is due either to acidosis or to a low blood-sugar, and to treat them with glucose and large doses of bicarbonate of soda. Such treatment disturbs the glycogenic mechanism and may introduce perverted habits of carbohydrate metabolism.

Symptoms of spontaneous hyperinsulinism do however occur occasionally, either in connection with tumours, benign or malignant, of the islets of Langerhans, or to insufficient function of the anterior pituitary lobe, or in connection with hypothyroidism and Addison's disease. Affections of the liver, or of the hypothalamic centre (Falta) may also be responsible for inducing a condition of hyperinsulinism.

Treatment. Tumours of the pancreatic gland, if they can be diagnosed, can only be treated surgically. Abundant administration of carbohydrate may relieve the symptoms, since it supplies material upon which the excess of insulin can act. Certain authorities however recommend in place of carbohydrate a course of exclusively protein diet. For rapid results, glucose is better than other forms of sugar, owing to the fact that it is in an assimilable form and requires no preliminary digestion; but to secure a sustained effect other forms of sugar, or starches are preferable, for they are only slowly converted into glucose.

Diabetes Insipidus

This disease, like diabetes mellitus, must be included amongst the diseases of the endocrine glands. It is a very rare disease, but quite as common, or possibly more common in young children than in adults. It represents a disturbance of water and salt metabolism, that is to say, of the osmotic regulation of the blood. It is almost certainly connected with some abnormality of pituitary function, and Zondek expresses the opinion that there is a similar antithetical relationship between polyuria and oliguria, due to pituitary defect, as between obesity of pituitary origin and pituitary cachexia.

Diabetes insipidus is characterized by great thirst and an excessive secretion of urine, sometimes amounting to 5 or 6 litres in the 24 hours.

There are two types of the disease—one, the so-called idiopathic,

in which no organic disease of the pituitary or other part of the brain can be demonstrated, and another in which there is definite trauma or organic disease of the pituitary. A small proportion of cases of the first class is accounted for by heredity. Others appear to be caused by " suggestion," or to be associated with the contraction of a habit of excessive drinking. These latter cases obviously offer a better prospect of successful treatment than those due to organic disease. A few cases are on record which have been due to a basal syphilitic meningitis involving the infundibulum or neighbourhood.

Treatment. Except in the transitory and functional forms of the disease, treatment is not satisfactory. Restriction of fluid intake, table salt, and protein food, has appeared at times to influence the disease favourably. Lumbar puncture has its advocates, but the only specific form of treatment of any value is the subcutaneous injection of Pituitrin (P. D. & Co.) to the extent of 0·5 c.c. twice daily. The rational basis of this treatment depends on the assumption that if the patient's pituitary gland is rested by the injection, it may eventually recover part of its lost or inhibited function.

CHAPTER XIII

INFECTIOUS DISEASES

The term "Acute Exanthem" is reserved for those specific fevers which are accompanied by a generalized rash, and includes scarlet fever, measles, German measles, chickenpox, smallpox, etc. It does not however cover specific fevers like typhoid, septicæmia, influenza, diphtheria, and psittacosis, etc., which sometimes, but not invariably, also present a rash.

The general management of most or all of the acute exanthemata is the same. For this reason, and to avoid repetition, detailed particulars of the general and routine treatment are given under "Scarlet Fever," and to this account readers are referred.

THE ACUTE EXANTHEMS

Scarlet Fever

Children under 2 years of age seldom develop an attack of scarlet fever. This may be so because children of this age lead somewhat sheltered lives, and are less likely to be exposed to infection than at a later age, or possibly because they do not always take the disease in the usual typical form, and so the diagnosis may be missed.

After 2 years of age the incidence of the disease becomes greater. Under 3 months of age infants are practically immune—at any rate they do not show positive reaction to the Dick test. That a good many children contract mild attacks of scarlet fever without the condition being diagnosed is suggested by the fact that the children of the poorer classes who live under crowded conditions and are presumably more exposed to infection, show a larger proportion of negative reactions to the Dick test than children of the upper classes. This can be explained on the assumption that many mild attacks of scarlet fever which confer immunity on the children of the poor escape detection.

Diagnosis. The importance of a correct diagnosis of scarlet fever before infection is broadcast is shown by the following

incident. In a home for infants under 5 years of age one of the inmates developed a rash and was sent to a neighbouring isolation hospital as a case of scarlet fever. After 10 days the child was returned to the home with a diagnosis of German measles. A few days later another case of the same kind occurred, and was followed by others, until every one of the children in residence, twenty-five in number, and four nurses out of a total of six, developed typical symptoms of scarlatina, for which they were referred to the same isolation hospital, and admitted and treated as such. An incident of this kind proves the importance of being able to recognize scarlatina when one meets with it, and induces me to refer to the matter of its diagnosis at some length.

Among the many conditions with which scarlet fever has at times been confused are the following: the prodromal rashes of measles, chicken-pox, smallpox, and the scarlatiniform phase of German measles: the rashes of Fourth, Fifth and Sixth diseases, of glandular fever, of erythema infectiosa, of erythema scarlatiniform as well as that so frequently seen in cases of intestinal disturbances in infants: drug rashes and the erythema due to the application of camphor liniment.

A differential diagnosis is greatly assisted if the patient happens to be a contact. In scarlet fever the onset is acute with shivering and vomiting, rapid pulse, coated tongue quickly becoming red round the edges, with prominent red papillæ, and later assuming the raspberry type. The face is generally suffused with a pink flush which avoids the area round the mouth, affording the so-called circum-oral pallor. The rash proper, which is of a punctate character, begins behind the ears and spreads rapidly down the neck over the chest and finally covers the whole body. The rash is said to be of darker colour in the lower parts of the body than it is in the upper. The condition of the throat is as a rule characteristic; the mucous membrane is covered with a dirty-looking slough, not altogether unlike diphtheria. The glands at the angle of the jaw and in the anterior triangle are generally enlarged also. Mucus taken from the throat and cultured on blood agar for 12 hours almost invariably shows a large number of colonies of hæmolytic streptococci.

The diagnosis of scarlet fever has however been put on a much surer footing since the introduction of the Schultz-Charlton test,[1] which is very reliable. It is performed by the intra-dermal injection of 0·2 c.c. of a 1 in 10 dilution of concentrated scarlet fever antitoxin. The injection must be carried out when the

[1] Bulbs containing 1 c.c. of scarlatina antitoxin sufficient for 5 tests can be obtained from Messrs. Parke Davis & Co.

rash is at its height, that is to say, during the 1st or 2nd day. If blanching occurs after 4–10 hours covering an area of half an inch from the point of puncture, it is strong positive evidence that the case is one of scarlet fever. A negative response does not disprove scarlet fever, but renders such a diagnosis improbable.

Dick Test. This test is often applied in conjunction with the former. A positive reaction by no means proves the existence of scarlet fever, it only proves that the patient is a susceptible subject. A negative reaction is however strong presumptive evidence that the case is not one of scarlet fever. The test itself consists in the intra-dermal injection on a pale area of skin of 0·2 c.c. of a 1 in 1,000 dilution of the filtrate obtained from a culture of scarlatinal streptococci [1] (Dick Toxin). Susceptible children thus tested show a circumscribed area of redness of ½ inch diameter at the seat of injection within 12–16 hours, reaching its maximum in 24 hours. A control injection can be given on the other arm with a similar amount of toxin previously inactivated by boiling.[1]

Treatment. *Prophylactic.* The prophylaxis of scarlet fever naturally depends on the avoidance of direct infection, and also on the boiling or pasteurizing of all milk consumed, but both active and passive immunity can be produced artificially by the injection of scarlet fever prophylactic, and the success or failure of the inoculation can be controlled by the Dick test. The possibility of conferring immunity by these means is of immense advantage when a child is exposed or is likely to be exposed to a known source of infection.

Passive Immunization. This kind of immunity can be obained within 24 hours by the injection intra-muscularly of 1·5 to 2·5 c.c. of concentrated anti-scarlatinal serum.[2] The immunity thus obtained lasts for 3 to 4 weeks. It is unnecessary for infants under 3 months of age, or for those with a negative response to the Dick test, but it is an invaluable prophylactic in those cases in which a child has been exposed to a known source of scarlet fever infection and is Dick positive. It is particularly valuable in institutions where a number of children are congregated.[2]

Active Immunization. Active immunization can be secured by a course of subcutaneous or intramuscular injections of scarlet

[1] Outfits for this test can be obtained from Messrs. Burroughs Wellcome & Co., or Parke Davis & Co.

[2] Bulbs containing 10 c.c. of the concentrated serum can be obtained from Messrs. Parke Davis & Co.

fever toxin. A preliminary dose should consist of 0·1 c.c. of scarlet fever Prophylactic A. (B.W. & Co.). If there is no reaction within the next few days the following doses should be given at weekly intervals :

(1)	0·2	c.c.	Prophylactic	A,	at	end	of	1st week.
(2)	0·8	c.c.	,,	A,	,,	,,	,,	2nd ,,
(3)	0·1	c.c.	,,	D,	,,	,,	,,	3rd ,,
(4)	0·5	c.c.	,,	D,	,,	,,	,,	4th ,,
(5)	1·0	c.c.	,,	D,	,,	,,	,,	5th ,,

Prophylactic A contains 2,500 skin tests per c.c. and Prophylactic D contains 50,000 skin tests per c.c.

The majority of those inoculated in the above manner become Dick negative within 1 month, but not before. This method of immunization is not therefore applicable in those cases in which immediate immunity is required. It is not known how long immunity lasts. In doubtful cases this question should be settled by a repetition of the Dick test after 6 months.

Curative.

Nursing. The child should be kept in bed in a well-ventilated room at a temperature of 60°–64° F. Open windows in favourable weather are to be encouraged, or better still open-air treatment on a balcony. In mild cases 14 days in bed is usually sufficient, but in serious cases the time must be considerably prolonged. Warm sponging has a soothing effect on irritability of the skin. The throat should be sprayed with some mild antiseptic lotion, such as Lotio Thymolis 1 in 8 (see page 704). That this procedure may lead to an extension of the inflammation to the middle ear and produce otitis media is quite contrary to my experience. The bowels should be kept open with a mild laxative, such as Milk of Magnesia, or Syrup of Figs. The urine must be tested daily for albumen.

Diet. The child should be kept on a restricted dietary as long as the pyrexia continues, but there is no rational reason, that I know of, why the food should be entirely fluid, except in the case of babies on a milk diet. It should consist of not more than ½ pint of milk in the 24 hours, to which Benger's Food may be added in cases of disturbed digestion. Otherwise, the diet should consist of broths, beef-tea, jellies, simple vegetables, oranges, grapes, sponge fingers, sponge cakes, and custard puddings. I strongly advise the giving of ices, especially water ices, to those children who are suffering from sore throats, and who

resent the swallowing of solids, or indeed of any ordinary kind of food.

With the subsidence of the pyrexia and the cleaning up of the tongue, a gradual return to a normal diet is indicated. I see no reason why meat, fish, and eggs, should not be given in small amount, even should nephritis supervene, but the main point to be observed in this, as in the dieting of all cases of sickness, is that over-feeding must be avoided, indeed the total caloric allowance of the fuel foods should be reduced by some 30 or 40 per cent. This is indicated because the child does not require any great amount of fuel as a source of either energy or heat, as he is immobilized in a warm bed. On the other hand, vitamins should not be restricted, nor should minerals, unless the kidneys are affected. For this reason the child should have ample supplies of citrous fruits, vegetables, and vegetable broths.

As regards the intervals between feeds, it is in my opinion a great mistake to depart from the usual meal-times. Frequent feeds do not give the stomach time to empty or recover before its functions are again exercised.

Specific Treatment with Anti-toxins. The specific treatment of scarlet fever by anti-toxin is now almost universally adopted, especially in hospitals and institutions. The treatment must however be given not later than the 4th day of the disease, and preferably much earlier. It should be noted that the anti-toxin is specific against the effects of the toxin, but it has little bactericidal action on the specific organism of the disease itself which produces the toxin.

The quantity of anti-toxin generally recommended for a small child is about 10 c.c. of the concentrated serum, and for a baby 1 year, or under, 5 to 8 c.c. Subsequently, if necessary, the inoculation may be repeated daily in increasing doses, up to double the amount of the initial dose, but not exceeding a total of 40 c.c. of the concentrated streptococcal anti-toxin (scarlatina)[1] during the whole period of treatment.

Another method is to inject anti-toxin serum of human origin in the form of convalescent serum. No doubt this is the ideal method, but convalescent serum from a late scarlet fever patient is generally difficult to obtain. After grouping it should be injected intravenously, and the amount given should be about 100 c.c.

[1] Bulbs containing 100 of the concentrated streptococcal anti-toxin (scarlatina) may be obtained from either Messrs. Burroughs Wellcome & Co., or Parke Davis & Co. Convalescent serum, or non-convalescent human blood must be obtained privately from any available donor.

Still another method, but distinctly inferior to either of the above, is the intravenous injection of non-convalescent citrated human blood, obtained from any available source, and of the right grouping. Since unselected human blood probably contains only a small quantity of anti-toxin, the quantity injected must be considerable, not less than about 200 c.c.

Treatment of Complications.

There are many possible complications which arise as sequelæ to scarlet fever. They may affect the kidneys, the heart, the lungs, the joints, or the nervous system, and they may be due to—

(1) The scarlet fever toxin.

(2) Secondary infections of tissues damaged by toxin.

(3) Direct spread of the specific infection from the fauces or adjacent tissues.

Of these complications, nephritis, rheumatism, otitis media, and serum sickness, are the most common, and will be the only ones referred to here.

Nephritis. Nephritis during the early stages of the fever is a transient complication, and generally arises during the acute toxic stage, that is to say, during the first 3 days. If the damage at this period or later is severe, an acute nephritis with hæmaturia or even uræmia may supervene, but most cases clear up completely without leaving any permanent damage.

Treatment. The treatment is the same as that for nephritis due to other causes, and mainly consists in giving the excretory functions of the kidneys as much rest as possible, by limitation of nitrogenous foods, extractives, and mineral elements. An exclusive milk diet, although often prescribed, is obviously contra-indicated, since it contains far too much protein matter, and beef-teas, broths, and meat essences contain too many extractives. The best diet consists of fruits, vegetables, and cereals, in fact a practically vegetarian dietary, since the end-products of metabolism of such foods, consisting as they mainly do of carbonic acid and water, will not throw any undue strain upon the kidneys. A small amount of protein food is a physiological necessity, but a sufficient quantity will be obtained from half a pint of milk in the 24 hours, or a small quantity of egg, fish, or meat. Large quantities of water, though generally recommended, are not in my opinion desirable, especially in cases where there is a tendency to œdema, for it must be remembered that water which is excreted by the kidneys imposes a certain amount of work on these organs, and may if not freely excreted lead to œdema.

Drug Treatment. This form of treatment is not as a rule indicated, but when there is an acid condition of the urine, or any other indication of acidosis, citrate of soda, or citrate of potash may be given in full amount.

Rheumatism. This may occur as a late complication in scarlatina, just as it occurs in any other form of streptococcal infection, tonsillitis for instance, and it usually develops after the same length of "silent period," namely, after about 21 days from the commencement of the disease, and it may take the form of endocarditis, carditis, or arthritis.

Treatment. The treatment is the same as that for ordinary rheumatism (see page 447), namely, that of alkalies, salicylates and guaiacol carbonate.

The local treatment in the early stages consists in keeping the affected joints well wrapped in cotton-wool, or by the application of mercurial ointment or Cataplasma Kaolin on lint. Later on, any unresolved articular or periarticular swelling should be treated by radiant heat.

Otitis Media.

Otitis of some kind occurs in from 7 to 8 per cent of all cases of scarlet fever. It may therefore be regarded as a fairly common complication. It is moreover a serious one, as it may result in deafness, or mastoid disease.

Treatment. The treatment is the same as that described on page 661 for cases of different origin.

Serum Sickness. Serum sickness may develop in any case in which anti-toxin treatment has been applied. It consists mainly of mild constitutional symptoms, a rash, œdema, albuminuria, and in young babies diarrhœa.

Treatment. The most satisfactory treatment for this condition, and especially for the skin irritation, is the hypodermic injection of 1–2 minims of 1 in 1,000 adrenalin solution, which may be repeated. I have also found 2–4 grains of chloretone particularly useful in the case of children, when rest is disturbed by the skin irritation.

Measles

(True Measles, Red Measles, Morbilli)

Measles is almost certainly due to a filter-passing virus. The incubation period is 8 to 17 days, most commonly 10 days. The eruption appears on the 4th day, and begins to fade between the 5th and 7th day. Infection lasts about 16 days, or in cases in which there is any morbid discharge, until such discharge has

dried up. Infectiousness is greater during the early stages before the rash has come out.

Diagnosis. This is often difficult. In the early stages it has to be differentiated from the common cold with coryza. Later, the rash has to be distinguished from those of German measles, scarlet fever, sepsis, and those due to toxæmia, serums, and enemas. The differential diagnosis can be made from the history, from the long prodromal period, the coryza, and the temperature chart, taken in combination ; but best of all by the presence of Koplick's spots. Great reliance can be placed upon this evidence. The spots are present in the vast majority of cases, and can easily be discovered if careful search is made for them during the 1st and 2nd day of invasion. After the specific measles rash has developed Koplick spots are either absent or difficult to recognize. They should be searched for on the buccal mucous membrane at the level of the upper pre-molar teeth, round the orifice of Stenson's duct. Each spot presents a small central bluish-white spot set on a red base. My general experience is that a mottled appearance of the soft palate and fauces, which may occur with any kind of inflammation, is mistaken for Koplick's spots. No diagnosis of Koplick's spots should be made unless there is a distinct bluish-white spot surrounded by a definite red area.

Treatment. *Prophylactic.* Measles carriers are unknown. Infection can be carried by the hands and clothing of attendants (fomites). It is also conveyed by droplets. The phase of maximum infectivity is during the pre-exanthem stage—*i.e.* during the en-anthem or coryza stage. It is useless to begin isolating cases of measles after the rash has appeared. The damage has already been done and scarcely any susceptible child will escape infection.

It is generally stated that infants under 3 months of age are not susceptible, but though this may be true in general, it is not true in all cases, for I have seen measles in a new-born infant only 10 days old, and in several under 3 months of age. It is however rare to find such cases for there is seldom exposure to infection at this age.

Convalescent Serum. In view of the severity of measles when it occurs in children under 5 years of age, especially during a virulent epidemic, or during the winter months, the great value of any reliable means of prophylaxis in cases in which one or more of the above conditions are fulfilled, needs no emphasis. The use of convalescent serum affords a definite means of prophylaxis, and generally proves most reliable. The only difficulty

is that the serum can seldom be obtained when it is most urgently needed.

Prophylaxis by this means is of two kinds. An attack may be warded off altogether, and passive immunity of a temporary nature afforded, or an attenuated attack of measles may be produced which confers an active immunity which will last an indefinite period.

The details of preventive inoculation are as follows:

> 5 c.c. of convalescent serum are injected into the gluteal muscles before the 5th day of incubation, that is to say, the 5th day after exposure. Such an injection will prevent the materialization of a genuine attack of measles, and confer passive immunity for a period of about 1 month.

The details of active immunization are as follows:

> 3 c.c. of convalescent serum are injected intra-muscularly from 6 to 10 days after exposure. By this means, if actual infection has really taken place, an attenuated attack of measles will develop, no later and no earlier than if no injection had been given, but the symptoms will be slight. Such an attenuated attack confers immunity for an indefinite period, probably not less than 2 years.

Convalescent whole blood can be obtained from any healthy patient who has recently had measles, and who is willing to act as donor. Such blood is of maximum potency when it is obtained about 15 days after the temperature has subsided to normal. It is important that the donor should have no complications, and should be otherwise healthy. Convalescent blood is not however always obtainable, but in default whole citrated blood from a healthy donor who has not recently had measles may be employed. In such cases larger quantities should be injected intravenously, probably 50 c.c. would not be too much. It should not be injected intravenously unless it has been grouped.

If the choice has to be made between preventive inoculation and the conferring of an attenuated attack, the choice should definitely be made in favour of the latter.

Convalescent serum is prepared from convalescent blood.[1]

[1] The blood should be sent to Messrs. Burroughs Wellcome & Co. at their Research Laboratories, Langley Court, Beckenham, Kent, suitably packed and preserved, where the serum will be prepared and returned to the sender with the minimum of delay.

The London Fever Hospital usually has a small supply of the serum, which they are willing to part with for suitable cases, but they restrict the issue to infants or children already affected with some other disease; in both these classes of case the additional infection of measles might prove dangerous or fatal.

It is regrettable that so far no organized effort has been made in this country to collect convalescent serum on a commercial scale, since if it were generally available many lives would doubtless be saved.

Curative Treatment. As far as general treatment and nursing are concerned the reader is referred to the account given in the section on scarlet fever (see page 388). These details are equally applicable in the case of measles, but I would particularly emphasize the importance of fresh air, or even open-air treatment. The old belief that the best way to avoid bronchitis and other complications is to keep the child in a hot stuffy room with draughts excluded, and to maintain his strength by excessive quantities of nourishing food, dies hard. The worst results of which I have had personal experience have been those in which this system has been adopted, and the best have been those in which the child has spent the period of sickness on an open-air balcony.

Drug Treatment. I must admit that my experiences confirm the view so confidently expressed some 10 years ago, namely, that phenazonum has almost a specific action in measles, with the necessary warning that some children show allergic or idiosyncratic reactions to this drug, and that consequently it must be given in the first instance with caution. I strongly recommend its administration in cases in which the child suffers any serious inconvenience from restlessness or sleeplessness, although in mild cases it may be quite unnecessary. The dose should be 1 grain, repeated and increased in quantity if necessary.

Complications of Measles.

The complications in measles are numerous, and include conjunctivitis, bronchitis, laryngitis, vomiting and diarrhœa, otitis, ulcerative stomatitis, cancrum oris, hemiplegia, meningitis, and encephalitis. All of these must be treated on appropriate lines, but certain special points deserve attention.

Conjunctivitis. In all cases the eyes should be shaded from very strong light. If open-air treatment is adopted an eye-shade should be worn. Since at the commencement of an attack of measles the eventual severity of the symptoms cannot be gauged, every case should be treated as potentially serious, and there are few sequelae more grave than those connected with the eyes. Panophthalmitis or complete destruction of the eye sometimes occurs, but total blindness is by no means uncommon. At the Sunshine Homes for blind babies (National Institute for the Blind) quite a large proportion of inmates owe their condition to a measles infection.

In simple cases of conjunctivitis in measles the eyes should be irrigated twice a day with boracic lotion. In more serious cases with a discharge of thick pus the eyes should be douched more frequently and a small quantity of " Adrenalin and Chloretone Eye Ointment " (Parke Davis & Co.) inserted between the eyelids. In all such cases an ophthalmic surgeon should be consulted.

Irritability of the Skin. Itching is often a troublesome complication of measles during the height of the rash. Fortunately it does not last long. Under such conditions the skin may be sponged with Liquor Carbonis Detergens, ½ oz. to the pint of warm water.

Cancrum Oris. This, like ulcerative stomatitis, is a severe complication, and only occurs in malignant varieties of measles. The treatment is the same as that for gangrene of other kinds, and consists in gently cleaning the surface with hydrogen peroxide 10 vols. diluted 1 in 6.

Encephalitis. This, together with all other nervous complications is of very serious import. It is supposed to be due to the direct action of the specific virus on the cortical cells. It generally commences with convulsions, which may be almost continuous, and the child may be unconscious. There is no known treatment for this complication, beyond the symptomatic one of allaying the convulsions with sedatives, such as bromide or chloral.

German Measles

(Rubella, Röthlen, Rubeola)

The chief point of interest about this disease is its differential diagnosis from scarlet fever and measles, although these are by no means the only conditions for which it is occasionally mistaken. Drug rashes, syphilis, and the fourth, fifth and sixth diseases, have all at one time or another been mistaken for German measles, or *vice versa*, but the diagnosis is definitely helped by a careful review of the history, as also by the presence of post-cervical adenitis, by a negative response to the Schultz-Charlton test, by absence of Koplick's spots, and by the characteristic blood picture. The rash itself begins behind the ears, and spreads over the face and the circum-oral region. It fades early and unequally, and consists of oval or round macules, sometimes confluent and palpable to the touch. The colour of the rash is pink and less punctate than in the case of scarlet fever. The complications are few and slight. There may be albuminuria, otitis media, or encephalitis.

Treatment. The infection is as a rule of so slight and transitory a character that very little in the way of treatment is indicated.

Prophylactic. Avoidance of infection by contacts, fomites, or droplets. No contact within 21 days after exposure should be considered safe.

Curative. The child should be kept in bed until the temperature, if any, has subsided, and treated dietetically as in the case of other specific fevers (see page 704). The patient should be regarded as infectious for 7 days after the appearance of the rash.

Throat symptoms should be sprayed with a mild antiseptic solution, such as Lotio-Thymolis (see page 704), or if the child is old enough to do so, he may be allowed to suck a formamint or other antiseptic lozenge.

Fourth Disease

(Sometimes known as Duke's Disease, or the Filatow-Duke's Disease)

This disease is of somewhat doubtful existence as a disease entity. It is said to have an incubation period of 9–21 days, which is a strong argument that it is not a modified form of scarlet fever, a view which has its adherents. The rash appears on the face without any prodromal symptoms. It avoids the circum-oral region and spreads rapidly over the entire body. It is therefore much the same as the scarlet fever rash, although as a rule less infectious. There may be slight coryza, tonsillitis, and "strawberry tongue." Desquamation is slight.

Fifth Disease

(Erythema Infectiosum)

This disease does not occur in epidemic form in this country, though extensive outbreaks have been reported in America and Germany. I, among others, have occasionally met with isolated cases which have corresponded with the accepted description of the disease. In one institution for infants under 5 years of age, there have been in the spring of successive years a few sporadic cases of erythema, which have greatly puzzled the local health authorities, the staff of the fever hospital to which they have been sent, as well as independent doctors who have seen the cases. Some declared for scarlet fever, others for measles, and yet others for German measles. I myself have never been satisfied that they were any one of these, and I felt they corresponded very closely with the recognized accounts of erythema infectiosum.

The incubation period is variable, from 5 to 14 days. The disease attacks children between 4 and 12 years, and the prodromal symptoms are very slight. The eruption appears first on the cheeks and forehead and takes the form of small macules which become confluent, constituting a sort of butter-fly pattern on the nose and cheeks. Later the rash spreads to the trunk and extremities, and lasts from 2 to 4 days. There is no desquamation.

Sixth Disease

(Exanthema Subitum, Roseola Infantum, Three-day fever of Glanzmann)

This disease is almost exclusively confined to infants under 2 years of age. It usually begins with pyrexia which lasts for 3 days, and is then followed with a crisis. When the rash appears it may last from 2 to 4 days. The distribution is not altogether unlike the rash which sometimes appears with influenza, and the blood picture also is rather like this disease, which does not appear to be highly contagious. The rash consists of small macules with irregular outlines. The spots often become confluent, but do not cause any irritation. The blood picture is one of leucopenia, with relative lymphocytosis. The increase in mono-nuclears is characteristic. The diagnosis mainly depends on the complete subsidence of temperature, and the symptoms, before the rash appears. Dr. Morris Witkin of Johannesburg draws attention to the prevalence of this exanthem in all parts of the world, and the frequency with which it escapes recognition.

Chicken-Pox

(Varicella)

Like smallpox this disease is due to a filter-passing virus. It is either the same disease as herpes zoster, or very closely allied to it. I have myself seen epidemics in which both diseases have owed their origin to one and the same source of infection. The chief difficulty in dealing with a supposed case of chicken-pox is to distinguish it with confidence from one of urticaria (strophulus or lichen urticatus) (see page 492), which is very common, or from smallpox (see page 399) which is relatively rare.

The following points will help to distinguish between these conditions :

(1) The history of other cases. Exposure to known sources of infection : the presence of old scars : the vaccination history.

(2) Prodromata—very insignificant in chicken-pox, with slight constitutional symptoms of pyrexia and headache : severe in

smallpox: absent in urticaria. There is, in the case of chicken-pox, occasionally a prodromal rash of scarlatiniform or morbilliform type. No Koplick's spots: Schultz-Charlton test negative.

(3) In chicken-pox the spots appear in groups presenting different stages. Macules last 24 hours: the vesicular stage lasts 24 hours: the spots are then collapsible on pricking: 24 hours later they become opalescent, flaccid, and crenated at periphery with red areola: in another 24 hours they become pustular, rupture, and scab. The vesicles are elliptical in shape with the long axes following the natural folds of the skin.

(4) The spots first appear in the mouth, hard palate, buccal mucous membrane, and then in order—on the chest, back, abdomen, adductor surfaces of the thighs, face and scalp. They occasionally involve the soles of the feet and palms of the hands. Spots in axilla very diagnostic (Rickets' "Sign of the Axilla").

(5) C. R. Amies [1] claims that the elementary bodies contained in the fluid from chicken-pox vesicles are agglutinated by the serum of convalescent chicken-pox patients, and that this constitutes a definite and specific test for the disease.

(6) In urticaria there may be a history of previous attacks: itching is more intense: dentition may be in progress, and there are never spots in the mouth, on the scalp, or the axilla.

Although with care chicken-pox and urticaria should not be confused, it may be said that no practitioner's education is complete until he has made the mistake once, but he should never make it a second time. I remember once demonstrating a typical case of lichen urticatus. The distribution of the rash in this case, as in all other cases of this variety of urticaria, took on a linear form, or at any rate made a pattern of straight lines of grid-iron or criss-cross design, mainly on the back, loins, and buttocks, and to some extent on the extremities, but not at all on the scalp, or face, and to prove the point that it was not a case of chicken-pox I opened the child's mouth and examined the soft palate and buccal mucous membrane. There to my surprise and confusion I found a number of distinct chicken-pox spots, proving in spite of the general distribution of the rash that the case was not one of uncomplicated urticaria. I found however on inquiry that the child had had the spots on the body for many weeks, but that it had been recently exposed to the definite infection of chicken-pox. So here was a case in which the two conditions co-existed. I only mention this to emphasize the value of the evidence of spots on the buccal mucous membrane as a means of distinguishing chicken-pox from urticaria, although

[1] *Lancet*, 1933, vol. i, p. 1015.

it has not the same value in the differential diagnosis between chicken-pox and smallpox.

Treatment. *Prophylactic.* Apart from measles, chicken-pox is probably the most infectious of all the acute fevers, and it is most communicable towards the end of the incubation period. The virus is carried by droplets or fomites, or in fact by anything used or soiled by the patient. Quarantine should be maintained for 10 days from the time of the commencement of the illness, or until every scab has fallen off. Contacts should be kept in quarantine for not less than 21 days.

Passive immunization should be effected by the intra-muscular injection of 5–10 c.c. of convalescent serum obtained from a donor who has had chicken-pox if possible not more than 1 month previously. It is claimed to be successful in 91 per cent of cases, but it is only required in special cases in which the attack might have serious consequences, as for instance in the case of an already debilitated child.

Curative. The child should be kept in bed during the pyrexial period, given a light simple diet, and a mild aperient, such as Milk of Magnesia 2 drachms. Otherwise he should be treated as directed for fever patients in general (see page 387). One of the main desiderata in the treatment is the prevention of scarring, which may take place owing to scratching. For this reason the child should have his nails cut short, or access to the face by the hands prevented by means of splinting at the elbow. Irritation may be to some extent allayed by sponging with a warm solution of permanganate of potash, pale pink in colour, or each spot may be touched with a stronger solution of this antiseptic, or with carbolized oil, which may be applied with a brush.

Smallpox

(Variola)

This specific fever is due to a filter-passing virus. It presents various degrees of virulence, so much so, that some believe there are actually distinctive types of the disease. For instance, the so-called " Western " or mild type, and the so-called " Eastern " or severe type. Moreover, there is evidence for believing that the virus of vaccinia is a still less virulent type of the ordinary small-pox virus. At the present time the mild or " Western " type is the prevalent one in this country.

Diagnosis. Smallpox has to be distinguished in its early stages from many other acute infections, such as influenza, lobar pneumonia, cerebro-spinal fever, scarlet fever, paratyphoid, and

encephalitis, and in the later stages when the rash has come out, from chicken-pox (page 397), and from lichen urticatus (page 492). The diagnosis is helped by the following facts :

(1) Smallpox practically never occurs in a successfully vaccinated individual with foveated scars within 5 years of the time of inoculation.

(2) When there is known to have been exposure to infection, and there are prodromata consisting of vomiting, headache, pain in back, and a " bathing drawers " type of rash, the case is likely to be smallpox.

(3) When the specific rash appears about 12 days after infection, and consists of shotty papules appearing first on the forehead and wrists, and then spreading over the entire body. (These papules become vesicular within 3 days, and pustular 5 days later.)

(4) When the blood picture assumes the recognized type.

(5) C. R. Amies [1] advises the application of agglutination tests with the sera of convalescent smallpox cases, or with that obtained from recently vaccinated persons. The elementary bodies of variola are agglutinated by such sera.

Treatment. *Prophylactic.* The infection is conveyed by droplets or fomites. The early stages are the most infective. Later on infection can be conveyed when the dried contents of the vesicles or pustules are transmitted through the air. Contacts who are not protected by vaccination must be regarded as infective for 16 days after exposure. No patient should be considered to be free from infection till all scabs have disappeared, and all ulcers or abscesses have become dry. Quite young infants are susceptible, as one would expect from the fact that they respond to vaccine inoculation. They do not appear to be completely protected by the ante-natal vaccination of the mother, or indeed when the latter has a genuine attack of smallpox during the period of pregnancy. Smallpox is a notifiable disease, and all cases which cannot be properly nursed and isolated in their own homes, should be sent to a fever hospital.

Vaccination. Vaccination affords almost complete protection against smallpox, and in countries where the practice of vaccination has been universally carried out the disease has been practically exterminated. In England, especially since the encephalitis scare, the disease has become more prevalent, owing to disregard of the precaution of vaccination. Since the Vaccination Order of 1929, which directed the substitution of a single linear

[1] Amies, C. R., *Lancet*, 1932, ii, p. 558.

scratch for the old method of multiple puncture, it has become customary to inoculate the vaccine after making a superficial scratch of one/eighth to one/quarter of an inch in length, and this limited operation is claimed to provide adequate protection for some 5 years, at a minimum of constitutional or local disturbance. The best way of performing the vaccination is to make the scratch with an ordinary sewing needle, which has been previously sterilized, and then to rub the vaccine into the incision by means of the same needle. The site of election is over the deltoid muscle, although for various reasons other situations may be chosen. In all cases the skin should be well cleaned with methyl ether before inoculation. The most reliable lymph to employ is the Government variety, which is usually supplied in 1–5 dilutions. It should be kept in a cold place, and used as fresh as possible.

Vaccination affords protection against smallpox if it is carried out not later than the 3rd day after exposure to infection, that is to say, during the first 3 days of incubation. At a later period it modifies and mitigates the attack. One successful inoculation provides protection for about 5 years. If further protection is required the patient must be revaccinated.

Complications of Vaccination. The commonest form of complication is septic infection at the site of vaccination, which may spread locally as erysipelas, or cellulitis, or it may become generalized as a septicæmia.

Owing to the prevalence of the view that eczema is often caused in children through vaccination, I would like to give qualified support to this opinion, although I know a great many professional vaccinators deny this possibility. Personally, I see nothing improbable on theoretical grounds in the association of vaccination and eczema, as " cause and effect," since eczema is an allergic disease, which may well be evoked by some allergen present in the vaccine itself. I have seen many cases in which eczema has followed immediately on vaccination, although of course this is no proof that it was caused by the inoculation. On the other hand, I have seen just as many cases of eczema which have appeared to me to have been greatly improved as a result of vaccination.

The Curative Treatment of Smallpox.

Nursing and Drugs. The patient should be kept in bed and completely isolated. All contacts should be vaccinated. Phenazonum 1–2 gr. seems to me to have a good effect on the headache, the itching, and the insomnia.

As for local applications, sponging of the skin with a pale pink

solution of permanganate of potash is said to allay irritation. In extreme cases where it is particularly desirable that pitting should be avoided, the child may be provided with a lint mask which has been immersed in the same solution. All scratching should be prevented by fixing the arms of the child to a sleeping-suit with safety-pins, or by attaching a cardboard collar to the wrists. The early injection of a drop of pure carbolic acid into a papule before it has become purulent is said to abort the progress of necrosis and thus prevent disfigurement by pitting: this may be important when prominent parts of the face are involved. Crusts and scabs can be removed by boracic acid fomentations, and after removal, the skin should be treated with carbolic acid ointment (2 per cent). The mouth requires attention, and should be swabbed frequently with a solution of chlorinated soda, diluted Dakin's solution, or dettol. The eyes should be irrigated with boracic acid lotion, and vaseline applied to the eyelids to prevent them from adhering.

Feeding. This must be conducted on the general lines laid down for specific fevers (see page 388). I would however specially emphasize the great comfort afforded to the patient by the swallowing of water ices, especially in these cases in which there is faucial involvement. In my opinion large quantities of water are not indicated.

ACUTE INFECTIONS OTHER THAN THE EXANTHEMATOUS FEVERS

Sepsis

Septic infections in young children may take various forms, usually classified as:

1. Toxæmias.
2. Septicæmias.
3. Pyæmias.

A *Toxæmia* is an infection in which the responsible septic organism remains localized in some particular area of the body, and exercises its harmful influence through the absorption of toxins which enter the circulation and are distributed throughout the body, doing special damage to the central nervous system, liver, and the kidneys. Diphtheria is an instance in point.

Septicæmia represents a general infection in which the micro-organisms are actually present in the blood, and multiply there. There are many varieties of septicæmia, for instance those due to

streptococci, staphylococci, gonococci, pneumococci, and the coli organisms.

A *pyæmia* is also a blood infection, but in addition there are localized or multiple abscesses due to the metastatic deposit of septic material or organisms in various parts of the body. Osteomyelitis, mastoiditis, otitis media, and suppurative arthritis, are examples of this infection.

The distinctions between these varieties of sepsis are not always clear-cut; they merge into one another. For instance, miliary tuberculosis is sometimes classified as a tuberculous septicæmia, although miliary deposits may actually constitute definite areas of suppuration and for this reason might come under the heading of pyæmia, but for practical purposes the term "Pyæmia" is applied to blood infections due to pyogenic organisms which produce local abscesses, wherever there has been any metastatic dissemination of the septic matter. Examples of septic infection in one or other of the above forms are erysipelas, cellulitis, tonsillitis, osteomyelitis, thrombo-phlebitis, infective endocarditis, liver abscess, pyelitis, otitis media, mastoiditis. Most of these are dealt with under their respective headings, and to these the reader is referred, but a few general remarks with reference to treatment are here appended.

Septic infections of the new-born belong to a class of their own, which has already been described on page 166. They are often difficult to diagnose owing to the feeble bactericidal reactions which they evoke, and by which sepsis is more readily recognizable in older infants or children. In new-born infants, for instance, there is often a leucopenia rather than a leucocytosis, a subnormal temperature rather than a pyrexia, and there is as a rule no definite lymphatic adenitis.

The general management and nursing of cases of sepsis involve the maintenance of the strength of the patient, by suitable rest in bed, and careful dieting. It is important not to throw any unnecessary strain on the digestive system, on the liver or on the kidneys, by overfeeding, or excessive protein intake, because the functional efficiency of these organs is probably impaired by the action of the circulating toxins.

Dehydration and acidosis are almost invariable concomitants of sepsis, and should be combated by the free intake of fluid or by the subcutaneous or intravenous injection of glucose saline with the addition of 1–5 per cent of bicarbonate of soda. I do not recommend in these cases the adoption of the continuous drip method of intravenous transfusion (page 715). It is altogether too complicated and vexatious to the patient.

The most important point, however, in the treatment is to identify the responsible organism in order that specific serological treatment, which holds out the only hope of successfully combating the infection, may be applied. Unless the organism can be isolated, from some local collection of pus, a blood culture must be made by collecting under aseptic precautions at least 10 c.c. of blood, which should then be transferred in quantities of 1–2 c.c. to 6 or 8 culture tubes, each containing 10 c.c. of a different liquid medium. These should be incubated under both anærobic and ærobic conditions for at least 7 days. If the responsible organism can be identified by these means before it is too late, the corresponding concentrated serum must be injected intra-muscularly or intravenously in appropriate dosage.[1]

In the case of pneumococcal, streptococcal, staphylococcal, and gonococcal infections, immunigens are now available and have been reported on favourably by those who have employed them. I cannot, however, speak of their value from personal experience. I can, however, speak favourably of the intravenous transfusion of ordinary grouped blood in those cases in which it has been possible to identify the causative micro-organism and inject the donor with the specific anti-toxin some days before taking his blood.

Septicæmia of the staphylococcic type may be treated with either stock on specific bacteriophage.[2] While treatment of septicæmia of the hæmolytic streptococcic type with Prontosil [3] has been favourably reported on. (See Appendix, p. 699.)

Enteric Fever

(Typhoid)

Enteric fever can occur at any age, but owing to the atypical form in which it usually presents itself in infants and young children, the diagnosis is often missed and the disease mistaken for some variety of gastro-enteritis, or for miliary tuberculosis, tuberculous meningitis, septicæmia, pyelitis, glandular fever, undulant fever, pneumonia, or influenza.

The diagnosis, which is extremely difficult in all children under 5 years of age, is facilitated by attention to the following points:

(1) The blood picture: there is usually a leucopenia with absence of eosinophiles.

[1] Refined and concentrated sera can be obtained for the treatment of pneumococcal, staphylococcal, streptococcal, meningococcal, and gas gangrene infections from Messrs. Parke Davis & Co.

[2] W. J. MacNeal and F. C. Frisbee, *American Journal of Med. Sci.*, 1936, cxci., 170.

[3] Bayer Products Ltd., Africa House, Kingsway.

(2) The presence of the specific organism in the blood, fæces, or urine.

(3) The Widal reaction. If this is negative in suspected cases a positive Weil-Felix test may confirm the diagnosis.

Treatment.

Prophylactic. The infection is carried occasionally in milk or water. In times of epidemic or in suspected areas both these should be boiled before consumption. Infection is also spread by soiled linen, stools, urine, and droplets sprayed in cases with broncho-pneumonia, and by flies. Typhoid carriers are occasionally a danger, but there is no record of one under 5 years of age.

The incubation period is usually between 10 and 15 days. Quarantine need not be continued after the stools have been negative on three successive examinations at weekly intervals.

The most important measure in prophylaxis is the careful and skilful nursing of all typhoid patients during the infective period of the illness, usually 4–6 weeks. This especially applies to the disposal of stools, urine, and soiled articles of clothing. The latter should be treated with a reliable antiseptic for 2 or 3 hours ; they may then be sent to the wash, while the former may be discharged down the drain. Monsol 1 in 40 serves this purpose well, or a solution of biniodide of mercury 1 in 5,000.

Specific Immunization. Neither active nor passive immunization is often practised in the case of babies or young children, but those going abroad or into infected areas can be actively immunized by means of the intra-muscular inoculation of anti-typhoid para-typhoid vaccine [1] the dose being 100 millions of combined organisms. At the end of 10 days a second injection of double the amount may be given. Protection is afforded by this means for not less than 1 year. This method has almost completely replaced the old method of passive immunization by means of anti-typhoid serum.

Curative Treatment.

Nursing. The most important item in the treatment of typhoid patients of this age is the nursing, not only in order to prevent the infection spreading to others, but also in order to recognize at the earliest possible date complications such as bed-sores, bronchitis, hæmorrhage, perforation, or cardiac failure. The patient should be kept isolated in bed, on a water mattress if possible, and in a well-ventilated room. Great care should be taken to prevent bed-sores, by friction of the back with spirit, and the free application of a good talc dusting powder.

[1] T.A.B., P. D. & Co.

The nurse who handles and changes the child should wear india-rubber gloves as well as an india-rubber apron, which should be frequently washed with some antiseptic solution. For this purpose Monsol 1 in 40 or 2 per cent lysol lotion is recommended.

The care of the mouth is another essential detail, for in the long-continued fever of typhoid it is apt to become septic and acid, leading to erosion of the teeth and dental caries. To prevent this the mouth should be frequently washed or sprayed with some antiseptic and alkaline solution, such as Borol (P.D. & Co.) diluted 1 in 12, and combined with milk of magnesia.

In summer the windows should be provided with screens to prevent conveyance of infection to others by flies.

Diet. The diet of typhoid patients is often made unnecessarily monotonous and unappetizing. It is quite easy with a little ingenuity and resourcefulness to fulfil all the essential requirements without rendering the diet actually nauseating or distasteful. In my opinion the first necessity is not to overfeed the child in the hope of maintaining his strength, for semi-starvation methods of treating enteric fever have been most successful. Small quantities of easily digestible food containing an ample supply of vitamins and mineral elements is required, rather than large supplies of the fuel foods. Milk itself, though generally the main standby of those who arrange typhoid dietaries, is not in my opinion to be recommended, because it becomes solid in the stomach, and at no time is easily digested. During the acute stage all milk given should be peptonized for 1½ to 2 hours, and flavoured with coffee, cocoa, or vanilla. Some authorities interdict all forms of fruit. Personally, I see great advantages in allowing moderate quantities of grapes and oranges, since by reason of the organic salts which they contain they tend to counteract acidosis. Punch Romaine is a very satisfactory form in which to supply alcohol in those cases in which it is indicated. Cold drinks of this kind are greatly appreciated by all fever patients, and may be given even to the youngest. It is quite easy to arrange an attractive menu for the day out of the following permitted articles:

Tea, Coffee, Chocolate, Custard (liquid).

Caramel pudding, Blancmange, Meat essences, Meat jellies, Vegetable broths, Water ices, Sponge fingers, simple biscuits: occasionally the juices of selected vegetables such as strained asparagus, mashed turnip, Jerusalem artichoke, vegetable marrow; and of fruits such as oranges and grapes.

Drugs. Drugs are not as a rule an essential element in the

treatment, but as already mentioned in connection with the care of the mouth, alkalies are indicated to prevent acidosis, and for this purpose milk of magnesia may be used if the bowels are not loose, or citrate of potash or bicarbonate of soda if they are. Intestinal antiseptics are of little, if any use. Small doses of calomel, formerly a very popular method of treatment, still has its adherents. Personally, I do not believe in the principle of flogging the overworked horse, or stimulating the overburdened liver by means of a cholagogue of this kind. On the other hand, I very strongly advise the giving of small doses of bismuth and petroleum in the form of cream of bismuth (see page 692), to lubricate the bowel, and prevent constipation, hæmorrhage, or perforation.

Specific Serum Therapy. Although not usually employed in the case of young children, this sometimes has its uses in cases of severe toxæmia. Serum prepared from the blood of a donor who has recently had typhoid, or who has previously been inoculated with T.A.B. has more to recommend it than the transfusion of larger quantities of non-convalescent blood, a method which has sometimes been employed.

Treatment of Complications.

Collapse may be treated by an intravenous or subcutaneous injection of glucose saline. Brandy or rum (1 drachm) diluted with water may be given by the mouth, or coramine (5 minims) may be injected hypodermically.

Hæmorrhage. An ice-bag should be applied to the abdomen, and 1 minim of opium or nepenthe may be given by the mouth.

Perforation. An immediate operation should be performed. In several cases this has saved a child's life.

Bacilluria. Hexamine to the extent of 4 gr. three times daily, may be given by the mouth if the urine is acid, or cystazol (page 353) to the extent of a half-tablet may be given when the urine is alkaline.

Hyper-pyrexia. Sponging with tepid water and the oral administration of 20 gr. of effervescent phenacetin with caffein.

Encephalitis or other Nervous Symptoms. These may be treated by 1 gr. of luminal, or 10 gr. bromide, repeated as often as necessary.

Paratyphoid

This disease, which in itself is only a particular and mild variety of genuine typhoid, occurs in several forms, the so-called A, B, and C types.

Paratyphoid B is the common form in Britain, and has quite

as wide a distribution as enteric itself. The differential diagnosis is helped by the development of an earlier and more profuse rash than is usual in the case of typhoid. Moreover, there is a greater tendency for involvement of joints and the development of respiratory symptoms. The diagnosis however can only be definitely settled by the specific agglutination reaction, which develops after the 10th day of the disease. Prognosis is better than in typhoid, but the treatment and isolation requirements are the same as in typhoid itself.

Influenza

It is almost certain that influenza is due to a filter-passing virus. Its effects on the infected person appear to be modified by a reciprocal or symbiotic action of the bacillus influenzæ (Pfeiffer's), the pneumococcus, the staphylococcus, and a variety of streptococcal organisms which in different combinations usually complicate the clinical picture. As each of these pathogenic organisms has its own particular degree of virulence under different conditions, there are infinite possibilities for variations in the severity of any individual attack, or in the form it may take. It is possible that an exogenous infection with the virus may be able to activate an existing latent infection of any combination of the above organisms.

The diagnosis is comparatively easy in times of epidemic, but sporadic cases may be mistaken for a number of other diseases, especially in infants who generally manifest the uniform symptoms of vomiting and diarrhœa no matter what be the particular nature of the infection.

The diseases which are particularly liable to be mistaken for influenza are encephalitis, meningitis, poliomyelitis, pyelitis, enteric fever, scarlet fever, smallpox, asthma, bronchitis, pneumonia, whooping-cough, glandular fever, or psittacosis. Unfortunately there is no specific test for influenza, but the combined presence of several of the above bacteria as revealed by a bacteriological examination of the nasal discharge renders the diagnosis probable.

Treatment.

Prophylactic. Influenza is highly infectious by droplet distribution. During cold and foggy weather infection is extensively spread in epidemic form. The incubation period is short, in certain cases it appears to be little more than 24 hours, but on an average it is regarded to be about 3 days. The period of infectivity is very variable, but it is certainly at its height during the early days of the disease, and especially when there are

coryzal symptoms. Some degree of infectivity persists as long as there is any nasal discharge, or fever.

It is doubtful whether inhaling eucalyptus oil or other aromatic or antiseptic vapour through the mouth or nose has any prophylactic value, but spraying the nose with an antiseptic nebula such as Parolein Compound (B. W. & Co.), or petroleum with 1 per cent thymol (see page 705) is in my opinion of undoubted use, as also is the sucking of Formamint lozenges by children who are old enough to do so, or by spraying the mouth of others who are too young for this treatment.

Specific Immunization. Owing to the multiple character of the bacterial infection, the possibility of latent or autogenous infection, and the impracticability of dealing directly with the virus, it must be admitted that the specific prophylaxis of influenza is at the present time somewhat of the nature of a " hit or miss " venture. In certain epidemics stock vaccines have seemed to me to have served their purpose, at other times they have proved to be useless. The majority of stock vaccines consist of mixtures of micrococcus catarrhalis, bacillus pneumoniæ, pneumococcus, bacillus septus, bacillus influenzæ (Pfeiffer's) and different varieties of streptococci.

The anti-catarrhal vaccine (P. D. & Co.) or the Public Schools anti-catarrhal vaccine (P. D. & Co.) are good. These mixed vaccines can be given safely to infants of the youngest age. For infants 1 year old the following quantities should be injected hypodermically on three successive occasions at weekly intervals :

1*st.*	½ minim	(0·032 c.c.)
2*nd.*	1 minim	(0·06 c.c.)
3*rd.*	2 minims	(1·2 c.c.)

These doses are larger than are usually prescribed, but in my opinion they are none too large to effect the purpose desired. In any case, immunity cannot be expected to last more than 3 months. At the end of that period the injections must be repeated.

Convalescent Serum. Although up to the present time we have had little or no practical experience in the use of convalescent serum as a prophylactic or therapeutic agent in influenza, there can be little doubt that if it could be obtained and injected after exposure, or during the incubation period, an attack would be prevented, or its severity materially mitigated. Personally, I should not hesitate in an appropriate case to inject intra-venously 5 c.c. of convalescent serum, if obtainable from a suitable donor.

Curative Treatment. The treatment must necessarily vary

with the type of case, as for instance, whether its main incidence is on the respiratory, nervous, or alimentary system. But in all cases the child should be kept in bed in a well-ventilated room, and during the acute pyrexial stages, that is to say, generally during the first 3 days, the diet should be limited and simple. If bottle fed the milk should be further diluted, or if the child is on a mixed diet it should be confined to weak tea, broths, jellies, grapes and oranges, and after the acute symptoms have abated the return to normal diet should be gradual.

Drugs. For the acute and early stages, there is to my mind no better drug than phenacetin in combination with caffein. It may be given either in the effervescent form (B.P.C.), or in tablet form: 20 grains of the former, or a ¼ tablet of the latter, are adequate doses.

After the acute stage, that is to say after the first 12 hours, I prefer to give a mixture containing salicin and quinine, rather than the more usual acetylsalicylic acid (Aspirin). The following formula is what I generally employ:

Salicin	2 gr. (0·13 gm.)
Ammoniated Tincture of Quinine	4 minims (0·25 c.c.)
Syrup	½ drachm (1·7 c.c.)

Peppermint water to make 2 drachms (7·0 c.c.)
Three doses of this mixture to be taken daily.

Complications.

Diarrhœa. Give prepared chalk ½ drachm, with ½ drachm of glycerin of carbonate of bismuth, to 2 drachms of water, every 4 hours until the diarrhœa stops. If thought necessary 1 drop of nepenthe may be added to the above mixture.

Constipation. Give 1 drachm of syrup of figs, or 1 drachm milk of magnesia, followed by regular doses of petroleum emulsion (Semprolin).

Bronchitis. Treat on the general lines indicated (see pages 257 and 268).

Nervous Symptoms (*Encephalitis, etc.*). Give bromide of ammonium with hexamine, 5 gr. of each with 2 drachms of peppermint water (four-hourly).

Cardiac Failure and Collapse. Give coramine 5 minims, by the mouth, or hypodermically; or ¼ gr. camphor in 10 drops of olive oil hypodermically.

Diphtheria

Diphtheria is due to the presence of the Klebs-Löeffler bacillus, a variety of "Corynebacterium," or club-shaped organism. It

is non-sporing, non-mobile, and ærobic. The disease as a rule can be recognized by the white, greyish-white or cream-coloured membrane which covers the affected parts, generally the tonsils, soft palate, and adjacent structures. It is however by no means confined to the faucial area, as occasionally the eyes, ears, nose, external genitals and wounded surfaces may be affected. The direct examination or subsequent cultivation of the organism recovered from nasal or faucial swabs greatly facilitates and expedites the diagnosis. There are however occasions when it is difficult to differentiate between diphtheria and the following conditions :

Scarlet fever, ulcerative tonsillitis, Vincent's angina, angina ludovici, retropharyngeal abscess, thrush, laryngitis, laryngismus stridulosa, acute lymphatic leucæmia, diphtheroid form of glandular fever.

The realization of the possibility of such mistakes in diagnosis together with a general survey of the history, the symptoms, and the clinical course of the illness, will usually obviate errors of this kind, but it cannot be too strongly insisted upon that whenever there are any reasonable doubts as to the nature of the illness, a positive diagnosis of diphtheria should be made temporarily, so that in case this diagnosis is correct the specific remedies may be applied at the time of their maximum efficiency, and not delayed until they are too late to save the child.

Treatment.

Prophylactic. Prophylaxis against the spread of infection is one of the most important of the duties of preventive medicine, and indeed of the general practitioner. For many years at The Infants Hospital, I have been constantly confronted with the difficulty of tracing carriers of diphtheria and tracking infections to their source. The introduction of the Schick test, and its corollary, prophylactic inoculation, has greatly relieved the situation by enabling us to search out dangerous carriers and so to protect susceptible contacts by immunization.

Schick Test. This is performed by injecting 0·2 c.c. diluted diphtheria toxin (B. W. & Co.) intra-dermally, into the front of the forearm. If the child is a susceptible subject a circumscribed area of redness about 1–2 cm. in diameter with slight infiltration of the skin will appear in 24 hours, disappear in a few days, and undergo a certain amount of desquamation at the end of 10 days. The reddened area should be compared with a control on the other arm, which is carried out by a similar technique with toxin which has been previously rendered inactive by exposure to heat. A pseudo-reaction is sometimes observed in the control, as well

as in the Schick-tested area. It develops almost immediately and is due to the presence of bacterial poisons, but it does not invalidate the real Schick test, which shows itself independently some 6 to 12 hours later.

Carriers of virulent diphtheria bacteria usually show a negative reaction, while a positive reaction is generally associated with the carriage of the non-virulent type. Eighty-five per cent of infants under 3 months of age are immune to diphtheria, and react negatively to the Schick test. By the time they are 1 year old this immunity has fallen to 20 per cent, but it continues to rise in the succeeding years until at the age of 20 it is again about 85 per cent. Slum-dwellers show a larger proportion of immunes, probably owing to unrecognized infections—"*Formes frustes.*"

Immunity. Immunity to diphtheria can be artificially procured in a passive, or in an active form.

Passive Immunity. This can be produced within 24 hours by the injection of 1,000 units of anti-toxin, but immunity thus provided quickly subsides, so that at the end of a month it has practically disappeared. It is therefore only a temporary measure in times of emergency.

Active Immunity. After a positive reaction to the Schick test, a child can be actively immunized by the intra-muscular injection of 1 c.c. of toxoid-anti-toxin mixture (T.A.M.), followed by two successive injections at weekly intervals. It is better before immunizing by this prophylactic treatment to make a trial injection of 0·1 c.c. of the same mixture, to make sure that there is no violent reaction after injection of the larger prophylactic dose. If at the end of 1 month from the date of the last injection the Schick test is still positive, an additional prophylactic dose should be given and repeated at weekly intervals as long as there is any positive response. Should however there be any anaphylactic reaction to the preliminary test inoculation, it is safer to substitute toxoid anti-toxin flocculate (T.A.F.) for the above mixture (T.A.M.). The only objection is that this variety of toxoid is more expensive. Since infants under 6 months are generally non-susceptible, they do not require immunizing, but in any case they respond badly at this age to inoculation. After 9 months of age a large proportion are susceptible, but so seldom suffer from violent reactions that they may be immunized if thought desirable, without any preliminary Schick test.

Treatment of Carriers. When a carrier of diphtheria has been detected by swab examination, the question arises whether the bacteria discovered is of a virulent or non-virulent type. This

can only be definitely settled by animal inoculation, and for this purpose a nasal as well as a faucial swab should be taken, and forwarded to Messrs. Burroughs & Wellcome Research Laboratories at Beckenham, from whom a report will be received in due course. As there is necessarily a delay of some 10 days or a fortnight, the suspected individual should meanwhile be regarded as a virulent carrier until proved otherwise, and kept in quarantine.

Treatment of Virulent Carriers. This is often a very difficult matter, and the only effective means of dealing with such cases is by the removal of tonsils and adenoids, tissues in which the virulent organisms are most likely to be harboured. Even after such individuals have apparently ceased to be carriers, they must frequently have swabs taken from both nose and fauces, since they are quite liable to relapse and again become a source of danger to others.

Curative Treatment. The treatment of diphtheria resolves itself into one of applying the specific remedy at the earliest possible moment after the diagnosis has been made, but the after care is of equal importance, and consists mainly in taking precautions against heart failure and certain forms of paralysis.

Feeding and Nursing. The child must be kept completely at rest in bed for 2 or 3 weeks from the commencement of the disease, and for the first fortnight should be kept flat on his back, and after that period only allowed to sit up when well supported by pillows. On the very slightest indication of circulatory trouble the child must again be made to assume the recumbent position with the foot of the bed raised. Careful observation must be kept for other indications of post-diphtheritic paralysis, such as nasal regurgitations, alteration in voice, diaphragmatic paralysis, or abnormality in gait.

As for feeding, unless there is any difficulty in connection with deglutition it is not necessary to adhere to a strictly liquid diet. After the first acute phase of the illness has passed, the diet should be of an ordinary nature, simple, but not excessive, and should consist largely of cereals, vegetables, fruit, eggs, and milk foods, with only a modicum of meat, fish, or poultry.

Specific Serological Treatment. Should there be any question as to the diagnosis the specific treatment should be applied, since little or no harm attaches to the use of anti-toxin, and there is much danger in delay. The serum of choice should be the concentrated variety containing 1,000 units per c.c.[1] The dosage should depend on the degree of the toxæmia, on the extent of

[1] Supplied by Parke Davis & Co.

the membrane, and on the time which has elapsed since the beginning of the infection. The age of the patient need not be taken into consideration, except in so far that it is still more essential in the case of young children that the full dose should be given. The dosage may be anything between 8,000 and 72,000 units, according to the conditions, but on an average about 16,000 units are required for cases of laryngeal diphtheria of moderate severity, and about 10,000 units for cases of nasal diphtheria. The injections should be given intra-muscularly, the seat of preference being the vastus externus muscle, at a point half-way down the side of the thigh. In very severe cases part of the serum may be injected intravenously, but under no conditions should more than 12,000 units be given by this route, the rest should be given intra-muscularly.

Desensitization. Violent reaction to the serum, so-called anaphylactic shock, is so rare in children, having in fact only an incidence of 1 in 50,000, that desensitization is rarely necessary, but in cases in which there may be a history of asthma or other allergic condition, or in which horse serum has been used more than 10 days previously, desensitization may be necessary. For a test inoculation 0·1 to 0·2 c.c. of the serum may be injected intra-muscularly or intravenously after dilution with five times its volume of sterile normal saline, or the undiluted serum may be inoculated intra-dermally. Sensitiveness is shown by the appearance within 5–30 minutes of a local or general urticarial rash, by a rise in temperature, or other constitutional symptom. If such supervene the same dose should be repeated within 1 hour, and if no symptoms then appear it may be given in double quantity, and if after this there is still no reaction, the full therapeutic dose may be employed.

If on the other hand the patient continues to show sensitiveness, attempts should be made by repeated small doses to reach the full therapeutic dose. As a precaution against possible anaphylactic reactions it is advisable to have at hand a solution of adrenalin, so as to be ready for any possible emergency: under such circumstances 2 minims of a 1 in 1,000 solution with 1/100th gr. of atropine in 5 c.c. of 5 per cent glucose solution may be given intravenously.

Treatment of Complications.

Obstruction in Laryngeal Diphtheria. If in spite of serum treatment laryngeal obstruction is sufficient to cause serious respiratory embarrassment, with recession of the intercostal spaces, the question of tracheotomy must be considered. It is often a matter of the nicest judgment to decide in any particular

case and under what circumstances surgical interference is indicated. In all cases when this question arises the child should be removed to a hospital where there are facilities for an emergency operation. In Budapest a method of suction under laryngoscopic control has apparently given good results which obviates tracheotomy.

Cardiac Failure. The effect of the toxins on the myocardium, or the cardiac nerves is to cause dilatation of the heart, with increased frequency of pulse, and a lowering of blood pressure. There may be dropped beats, extra-systoles, or even heart block, and owing to such circulatory failure secondary enlargement of the liver and suppression of the urine. These symptoms however do not as a rule come on until the 2nd or 3rd week of the disease.

Streptococcal Infections. In the severe forms of diphtheria the infection is very frequently complicated by the co-existence of a streptococcal infection, which is usually hæmolytic. Under such conditions the streptococci are apt to mask the presence of the Klebs-Löeffler organism in swabs taken from the patient. Practitioners should always be aware of this possibility. In all cases in which there is a mixed infection of this kind, anti-streptococcal serum should be given in combination with the anti-diphtheritic serum. The dose should be about 5 c.c. of the refined and concentrated polyvalent anti-streptococcus serum.[1] This should be combined with about 10,000 units of the anti-diphtheritic serum.

Other complications that may arise in the course of an attack of diphtheria are broncho-pneumonia, diaphragmatic paralysis, erythematous rashes, relapses, and in cases in which horse serum has been employed, serum sickness.

Whooping-cough

(Pertussis)

Whooping-cough is a highly infectious disease, associated with, or possibly due exclusively to, the presence in the blood of Bordet's bacillus pertussis. This organism is nearly always accompanied in cases of whooping-cough by secondary infections with the bacillus influenzæ (Pfeiffer), and the pneumococcus. There are reasons for believing also that the bacteriology of whooping-cough may be further complicated by the presence of a specific filter-passing virus.

The incubation period is generally stated to be from 7 to 19 days, although it is often difficult to fix the precise moment at which the disease begins. Quarantine precautions must be

[1] Parke Davis & Co.

observed for 4 weeks from the commencement of the whoop, and contacts must be held suspect for 21 days. The disease is mainly communicated by droplet infection, but it is possible that if vomited material is allowed to become dry and to be disseminated by wind or flies, infection may be effected by this means also. The disease is so widely distributed that the majority of children are infected before they reach adolescence. Those who appear to escape the disease altogether have in all probability suffered from an undetected attack (*Forme fruste*). There are definite reasons for believing that whooping-cough can occur without the whoop, and this is specially true in the case of young babies who are particularly susceptible and are quite liable to die from concomitant bronchitis or broncho-pneumonia. There are cases on record in which new-born infants have developed the symptoms so soon after birth that it is almost impossible to believe they have not been infected *in utero* by their mothers.

The diagnosis of the disease, which in all cases is very difficult during the early stages, is helped by the consideration of the following facts :

(1) Whether or no there is a definite lymphocytosis.

(2) Whether the intervals between the attacks of coughing become longer and more spaced out as the disease develops, while the attacks themselves become more violent and more spasmodic.

(3) Whether an attack of coughing may be elicited by pressure on the trachea just below the cricoid cartilage.

(4) Whether the Bordet bacillus may be grown by making the patient cough on to a Petri dish covered with a specially prepared culture medium.

(5) Whether there is apprehensiveness of the child at the prospect of an impending paroxysm.

(6) Whether there is a congested appearance of the face, and suffusion of the eyes with copious secretion of tears during the attack.

Treatment.

Prophylactic. The prevention of whooping-cough is one of the most important of the duties of the practitioner and of the Public Health Service, since of all epidemic diseases it is the one which causes most physical suffering, most loss of school attendance, greatest impairment of physique, and highest mortality.

Prevention largely consists in the adequate isolation of the patients during the whole infective period of about 4 weeks, and in the rigid observance of quarantine regulations. The disinfection of handkerchiefs used by the patients, and the safe disposal

of sputum or vomited material is an important element in the prevention of the spread of infection.

Specific Immunization. In view of the serious nature of possible complications and sequelæ, it is to my mind quite a reasonable proposition that all children who have not already had an attack of whooping-cough should if possible be artificially immunized. My own personal experience is that if the immunization is carried out with due regard to detail by the injection of a combined vaccine containing Bordet's bacillus, Pfeiffer's bacillus and the pneumococcus, almost complete protection is afforded. It is however of little use if carried out during the incubation period after actual infection has already taken place.

The details of procedure are as follows : There should be three consecutive injections of 0·2 c.c. ; 0·4 c.c. ; and 0·8 c.c. of " B " Whooping-cough prophylactic vaccine (Parke Davis & Co.), at intervals of 4 days. Such inoculations cause practically no constitutional disturbance, and a relative degree of immunity is afforded at the end of treatment, at least such has been my experience.

Serum Prophylaxis. Temporary passive immunity can be obtained immediately by the intravenous injection of from 5 to 10 c.c. of convalescent serum, obtained from a suitable donor who has had whooping-cough 4 or 5 weeks previously. This treatment may be given during the incubation period. If given during the first few days after infection it may stop the attack altogether, but if later, it only has a mitigating influence.

Curative Treatment.

Nursing and General Management. Uncomplicated cases of whooping-cough should not be treated on the orthodox lines applicable in ordinary cases of fever, that is to say, by confinement in bed. I believe more harm is done by keeping whooping-cough patients in hot stuffy rooms with Formalin lamps burning, than by the disease itself. Fresh air, or indeed open-air treatment, is in my experience by far the most important element in the successful treatment of the disease.

There is quite rightly a widely shared anxiety lest bronchitis or broncho-pneumonia should complicate the disease, and many a child is incorrectly diagnosed as suffering from such when the real trouble is tracheitis. No child should be condemned to the strict régime required in the treatment of genuine bronchitis unless the practitioner can assure himself quite definitely by the presence of râles in the chest and other confirmatory evidence that the patient is really suffering from involvement of the bronchial tubes. Both bronchitis and broncho-pneumonia are very much

more likely to supervene if the child is kept under hothouse conditions, than if he is allowed to spend the greater part of his time in the open air, with the necessary reservation, however, that the weather is suitable. In summer-time, or even in early spring or autumn, the conditions are usually favourable for open-air treatment, but even in winter a whooping-cough case need not be confined to the house, but may be allowed to go out of doors whenever suitable opportunities present themselves without danger of spreading infection.

Feeding. Owing to the vomiting the times of meals should not be fixed arbitrarily by the clock, but so arranged as to follow, rather than precede, a paroxysm of coughing. By these means at least a part of the meal may have left the stomach before the next attack of vomiting occurs. There is no need for any special kind of food, or any special exemptions. The child should be allowed his ordinary meals, and need not be pressed to take unusually large quantities. If these principles are observed I have often noticed that the child will actually put on weight during an attack of whooping-cough, owing I believe to the fact that the vomiting imposes a very desirable check against overfeeding, one of the most common causes of malnutrition in young children.

It is particularly necessary during a prolonged infection of this kind, to ensure that children receive a full allowance of all the accessory food factors, that is to say, of mineral elements, as well as of vitamins, by allowing them a plentiful supply of vegetables, oranges and other fruits. If thought desirable, additional accessory factors may be given in the form of Marmite, Bemax, cod-liver oil or halibut-liver oil, as well as of nutritive salts (see page 696) during the whole period of the illness and for some time during convalescence.

The bowels should be kept in regular working order, but purgatives or even aperients are not as a rule indicated. Small regular doses of a petroleum emulsion, such as Semprolin, are useful for lubricating the bowel and compensating for the reduced intake of food which is a usual consequence of the vomiting.

Drugs. I believe more harm than good is usually done by the giving of sedative drugs with the hope that they will control paroxysms of coughing, and this is particularly true of such drugs as luminal, bromoforme, benzyl-benzoate, adrenalin, and chloretone, but I realize that it may be difficult to resist the importunity of parents or nurses who clamour for something to stop or mitigate the terrors of the attack, but short of anæsthetizing the child I have never found any drug which in the long run

affords any recognizable benefit. I have noticed however that children who are old enough to inhale a sedative nebula which can actually reach the affected part of the trachea, do derive some benefit from the use of Adrephine or Chloretone inhalant (Parke Davis & Co.). As already stated, I do not advise the use of a Formalin lamp, neither do I advise intra-muscular injections of ether, procedures which are sometimes adopted.

Convalescent Serum Therapy. The use of convalescent serum at the beginning of an attack is a rational and useful procedure, but the difficulty is to get the serum when it is required : 5–10 c.c. of serum derived from a convalescent donor who has had the disease for 4 or 5 weeks previously, will certainly modify the attack if it is given during the early days of incubation.

Complications and Sequelæ.

Broncho-pneumonia is the most common of all complications. It is more likely to occur during the winter and among cases which are confined to bed, and treated by Formalin lamps, steam kettles, and tents.

The general treatment must be conducted as described on page 268, while stimulants and heart tonics are usually required.

Cerebral Complications. Convulsions, epilepsy, hemiplegia, and meningitis, are all occasional nervous complications, and may be due to the toxic action of a virus, if there is one, or of the responsible infective organisms, or, rarely, to œdema or hæmorrhage. Each of these must be treated on the lines which are given under their respective headings.

Involvement of Bronchial Glands. It is probable that in all cases of whooping-cough the bronchial or mediastinal glands are enlarged, predisposing materially to secondary tuberculous involvement. For this reason convalescent treatment is more important after whooping-cough than in other infectious diseases. In all cases in which it is possible the patient should receive climatic treatment, at the seaside if possible, as soon as the infectious period of the disease has passed. I also make it an almost invariable rule to prescribe for such children small but regular doses of Syrup of Iodide of Iron ; 20 minims three times a day is a sufficient dose for a child 1 year of age. This serves as a tonic, and also promotes absorption.

Mumps

(Epidemic Parotitis)

As a rule there is little difficulty in the diagnosis of mumps. There is usually a history of exposure to infection ; the gland

itself is definitely enlarged : there is pain on opening the mouth, as well as pyrexia, malaise, and other constitutional symptoms common to general infections. Any of the salivary glands may be affected, submaxillary or sublaryngeal, and so may the testicles, ovaries, pancreas, thymus, as well as the lymphatic, or mammary glands. The practitioner ought to be on his guard against such possibilities which may complicate the diagnosis.

Treatment.

Prophylactic. Mumps is highly infective, but infants under 1 year of age show little susceptibility, although there have been instances of epidemic parotitis in new-born infants whose mothers have had the disease during the later weeks of pregnancy. The infection passes directly from person to person, probably through the medium of the saliva, which is highly infectious. It is questionable whether the infection can be conveyed by a third person, or by contaminated clothing or articles which have been used by the patient. Owing to the long incubation period of mumps, contacts must be kept in quarantine for 30 days from the last occasion on which they have been exposed to infection. A child may be considered free from infection 1 week after the swelling of the gland has entirely disappeared. This may be less than 14 days from the beginning of the disease.

Sero-prophylaxis. A child may be rendered temporarily immune to mumps by the intra-muscular injection of 5–15 c.c. of convalescent serum, obtained from a donor who has had the disease not less than 10 days from the onset of symptoms, and if possible not more than 20 days after their subsidence, but inoculation is effective during the first 6 days of incubation. After that time it does not prevent the disease, but may possibly mitigate the severity of the attack.

Curative. Rest in bed is essential to avoid possible complications such as encephalitis, pancreatitis, or orchitis, all of which are serious.

Feeding, which should be conducted on the usual lines suitable for fever patients (see page 388), is sometimes difficult owing to pain on opening the mouth, or on mastication. Under such conditions the child should be fed on fluids which he can suck through a straw or glass tube.

The mouth, which is inclined to become dry and septic, should be frequently wiped out or sprayed with an antiseptic lotion, such as thymoline (page 704), or borol (P. D. & Co.), diluted 1 in 12. Fomentations applied over the swelling relieve pain, or lint spread with warm glycerine of atropine will effect the same purpose :

20 grains of effervescent phenacetin with caffein (B.P.C.), dissolved in 2 oz. of water, will relieve the malaise and other constitutional symptoms. Martiny [1] has found that oral administration of minute quantities of lead triturated with milk sugar and placed on the tongue every hour, aborts the disease in 24 hours—I have no experience of this method.

During convalescence, syrup of ferrous iodide, to the extent of 20 minims three times a day, is recommended.

Psittacosis

(Parrot Disease)

This comparatively rare disease generally manifests itself in epidemic form, in which infection spreads from sick parrots, parakeets, macaws, or love birds. The incubation period is stated to be from 7 to 10 days, and the infection itself to be due to a virus. Infection may possibly spread from person to person, but rarely attacks children.

This disease takes the form of a general septicæmia of typhoid type, with a special affinity for the lungs, which generally show a peculiar form of pneumonia, starting rather late in the disease, and causing a very massive consolidation, little cough, or expectoration. The only specific test for the disease so far available is the intraperitoneal injection of the patient's sputum or blood into mice. In positive cases the mice develop symptoms within 7–10 days, and usually die within 14 days. In sporadic cases the diagnosis has to depend largely on a history of contact with a sick bird, and the peculiar character of the pneumonia. Psittacosis may be mistaken for septicæmia, influenza, typhoid, or pneumonia. The fact that a Widal reaction is sometimes positive helps to complicate the diagnosis.

Treatment. *Prophylactic.* Prevention mainly depends on the removal of the source of infection, namely, the destruction of the sick bird. Although infection is rarely conveyed from person to person, it is a wise precaution to isolate children suffering from the disease.

Curative. In children abdominal symptoms appear to predominate, and owing to certain analogies with typhoid, in their case the treatment should take the form of that recommended for enteric cases (see page 409). So far no dependable specific serological treatment has been discovered, but convalescent serum has been favourably reported on in cases in which it has been possible to find a suitable donor.

[1] *Bull. Soc. de Ther.*, 1933, vol. xxxvi, p. 72.

Glandular Fever

(Infective Mononucleosis)

One of the most important features of this disease is the difficulty that exists in the correct diagnosis of sporadic cases. In epidemics its recognition is simple. At other times it may be confused with diphtheria, mumps, tuberculosis, tonsillitis, leukæmia, lymphadenoma, influenza, or appendicitis. Mistakes in diagnosis may best be avoided by attention to the blood picture. A differential white cell count shows an absolute as well as a relative mononuclear lymphocytosis. The spleen is generally enlarged, and occasionally the liver also, and the enlarged glands are painful and tender. There is usually an indefinite prodromal stage, lasting 3 to 5 days, before the enlargement of the glands takes place, and during this time there is some pyrexia, sore throat, and nausea. There may also be a scarlatiniform rash (roseolar).

The glands generally affected are the post-cervical, but lymphatic nodes in any part of the body may be involved, as for instance the mediastinal, abdominal, inguinal, or axillary.

Treatment. *Prophylactic.* The infectivity of glandular fever is slight, but when possible the case should be isolated, and not nursed in the same ward with other patients. Contacts may be regarded as potential cases for 14 days after the last exposure, which is about the limit of the incubation period. It is believed that the prodromal or sore-throat stage is the most infective.

The most susceptible age is 5 years, but infants are by no means exempt.

The complications and sequelæ are neither numerous nor severe, and prognosis is definitely good, and for these reasons no elaborate steps are necessary to prevent the spread of infection, but it may be safely assumed that convalescent serum, if it can be obtained, is protective within limits, but probably not later than the 4th or 5th day after exposure.

Curative. The child should be kept in bed and isolated if convenient. The dieting should be the same as that for ordinary fever cases (see page 388). There is no known specific remedy, but the almost invariable lymphocytosis which accompanies the disease suggests that a nuclein preparation such as Metatone (P. D. & Co.) is a rational line of therapeusis in view of the fact that it increases the germicidal properties of the blood. It may be given to the extent of 30 minims three times a day.

Pyrexia, sore throat, pain, nausea, vomiting, epistaxis, and any other concomitant symptom must be treated on general principles.

In my experience pain in the neck is the symptom which gives most trouble, and this is best treated by frequent fomentations with glycerine of atropine and by effervescing phenacetin with caffein (B.P.C.) 20 gr. in 2 oz. of water occasionally.

Undulant Fever

(Malta, Mediterranean, Cyprus, Goat, Gibraltar and Rock Fever)

This disease as its name implies is characterized by its undulating or irregular temperature. It runs a very chronic course, and sometimes lasts as long as 6 or 7 months. It is subject to remissions and relapses, and is due to the presence in the body of one or other of the following types of bacillus, brucella melitensis, or brucella abortus. These two may be only variants of one and the same bacillus—brucella melitensis is parasitic in the goat, and gives rise to so-called Malta or Mediterranean fever, which appears to differ in certain minor respects from that form of undulant fever which is due to brucella abortus, and which is the common form in this country. Brucella abortus has a very widespread distribution amongst cows, horses, dogs, and other domestic animals, and gives rise to infectious abortion in cattle.

The disease is mainly spread among human subjects through infected milk, but it can also be disseminated by direct contact with infected animals or persons. It probably has a much wider distribution than is generally believed, since mild cases, especially in children, are liable to escape recognition. It has been proved that approximately 30 per cent of all the raw milk distributed in this country is contaminated with brucella abortus, while cream, butter, and soft cheeses are by no means exempt.

The general symptoms of the disease, apart from the long-continued irregular pyrexia, are malaise, weakness, insomnia, loss of appetite, mental depression, headache, rheumatic pains, especially deep-seated bone and muscle pains, profuse sweating, enlarged spleen, lymphatic adenitis, leucopenia, anæmia, and bradycardia.

Although undulant fever is stated to be almost unknown in children under 5 years of age, there is every probability that this belief is due to difficulties in diagnosis, rather than because children of this age have any natural immunity to the infection. Apart from the recognized symptoms, and the chronic course which the disease runs, the diagnosis must depend on agglutination tests, and the recovery of the organism from blood, fæces, or urine.

Treatment. *Prophylactic.* The chief source of infection is

unboiled, infected milk. Unless infants and young children have some natural immunity to the disease, as the chief milk consumers a very large number of them must suffer from undetected infection (*Formes frustes*). The boiling or pasteurization of milk affords complete protection from this source of infection. The conveyance of infection by direct contact with animals suffering from the disease appears to be a rare occurrence, although the possibility must not be overlooked.

Curative. There is very little to be said on the subject of the treatment of undulant fever in the case of infants and young children, because so far few cases [1] have been reported, but judging from its effect in the case of older individuals, treatment by means of the intra-muscular injection of neoarsenicobenzol [2] may also have value in the case of younger subjects.

The method of inducing protein shock in patients suffering from this disease also has its advocates, but I have no personal experience of its application. The intravenous administration of typhoid vaccine is said to be the best method of effecting this object. This may be done by administering a dose of vaccine containing 100 millions of combined organisms (T.A.B., P. D. & Co.).

In America good results are reported from the direct transfusion of blood. In the case of an infant 1 year old, the amount should not be less than 100 c.c. In other respects the disease should be treated symptomatically.

Bornholm Disease

(Devil's Grip Epidemic, Transient Diaphragmatic Spasm, Myositis Acuta Epidemica)

This disease is supposed to be very rare in Britain, but it is common in Scandinavia, and epidemics of it have broken out in Bornholm—an island in the Baltic, from which the disease derives one of its names.

It is possible that its supposed rarity in this country is due to the fact that so little is known about it that when it does appear it fails to be diagnosed. I think it very probable that it is the same disease as so-called epidemic pleurisy, several epidemics of which have been reported.

In 1934 there were a number of cases of this disease in Bognor, but its true nature was not recognized until towards the end

[1] "Undulant Fever in Infancy"—Williamson and Gibbons, *Brit. Med. Jour.*, June 2nd, 1931, p. 748.

[2] Widal, J., *Paris Méd.*, 1933, p. 223.

of the epidemic. A particular case which I saw in this epidemic was that of a boy 7 years of age, who had a somewhat atypical attack not unlike encephalitis, but sufficiently like the description that I received of the other cases in the neighbourhood for me to feel fairly sure that this also was a case of Bornholm disease.

Most of the cases which have been described have presented the characteristics of a commencing pneumonia with pleurisy —that is to say—high temperature, rapid pulse, rapid shallow breathing, and acute pain on coughing, or on taking a deep breath, but no other of the physical signs of pleurisy. At the end of 2 or 3 days all the symptoms disappear, leaving the patient perfectly well and without any sequelæ.

Most of the cases are diagnosed as " Abortive Pleurisy."

The special points by which the disease may be distinguished are the acute abdominal pains, profuse sweating, absence of sore throat, but occasionally the presence of nasal catarrh and conjunctivitis. It may very easily be mistaken for influenza, pleurodynia, dry pleurisy, pneumonia, acute abdomen, or shingles, but is not likely to be confused with these during times of epidemic.

Treatment. So far no treatment has proved of the least avail, but phenacetin in the form of effervescent phenacetin and caffein (B.P.C.), given to the extent of about 20 gr. in 2–3 oz. water, certainly relieves the pain.

Pink Eye

(Epidemic Conjunctivitis)

This disease is becoming more and more troublesome in schools and other residential institutions where many children are congregated together, and causes often great anxiety to school medical officers.

The disease is not a serious one, but it is so highly infective and spreads so rapidly that it may go through a whole institution without leaving one single inmate exempt. The disease may be due to one of several organisms, the Koch-Weeks bacillus, the Morax-Axenfeld bacillus, various streptococci and staphylococci, or the pneumococcus.

Treatment

The treatment consists in complete isolation, darkened rooms, smoked glasses, avoidance of eye-strain, and the local treatment of the eyes by frequent irrigation with boracic acid lotion.

It is claimed that for cases due to the Koch-Weeks bacillus, an ointment containing a silver preparation, such as argyrol 2 per cent has special virtues, while for the Morax-Axenfeld bacillus

a 5 per cent zinc ointment has a more specific action. For other forms of the infection, ordinary Golden ointment (yellow mercuric oxide ointment) 2 per cent is recommended.

I cannot speak from personal experience of the advantages of observing these nice distinctions in treatment, but I can speak in very favourable terms of the routine treatment of all cases of pink eye, irrespective of their special type, by means of castor oil in which acriflavine (strength 1 in 1500) has been dissolved.

Cerebro-spinal Fever

(Meningococcal Meningitis and Spotted Fever)

This disease is an acute specific fever, which usually occurs in epidemic form, but is occasionally found sporadically. It is due to the diplococcus intracellularis. The diagnosis is usually easy, and is assisted at times by the presence of characteristic purpuric or herpetic spots, from which the disease derives its name spotted fever. The diagnosis however can be definitely confirmed by a bacteriological examination of the cerebro-spinal fluid, which is turbid and contains the diplococcus.

Two types of the disease are recognized :

(1) The cerebro-spinal type in which the incidence of the inflammatory process falls mainly on the cerebral ventricles, and the meninges.

(2) Posterior basic meningitis, which occurs mainly during the first 12 months of life, and is specially characterized by retraction of the head, opisthotonus, the absence of spots, and a tendency to blindness which may be temporary or permanent. The inflammation is mainly confined to the base of the cerebellum, and the neighbourhood of the 4th ventricle, but it may also involve the optic chiasma.

The diagnosis has sometimes to be made between cerebro-spinal fever and otitis media, pneumonia, retro-pharyngeal abscess, thrombosis of the longitudinal sinus, mumps, tuberculosis, influenza, pneumococcal and septic meningitis, and also from encephalitis, but as previously stated, the diagnosis of spotted fever can be confirmed by examination of the cerebro-spinal fluid.

Treatment.

Prophylactic. The incubation period is short, from 2 to 4 days. Infection is probably conveyed by droplet dissemination from the naso-pharynx of infected persons, and by carriers. As a general rule the patient is not infective after the 3rd week of the illness. Usually children suffering from this disease are nursed in a general ward, but in view of the possible dissemination by droplet dis-

tribution, it would be wiser to nurse them in isolation. How long a carrier continues to be infectious it is impossible to say. It is generally believed that he loses his infectivity very rapidly, but my own experience does not bear this out. We admitted to The Infants Hospital two brothers suffering from cerebro-spinal fever at an interval of 1 year. The father was found to be a carrier.

The treatment of carriers is extremely difficult. If they have enlarged or unhealthy tonsils, the latter should be removed, and in all cases the throat and naso-pharynx should be sprayed with a strong antiseptic solution, such as Fecto (page 705) in a 1 in 12 dilution.

Specific Immunization. Both carriers and normal children who are known to have been exposed to infection, or are likely to be so, can be actively immunized against cerebro-spinal fever by inoculation with meningococcic vaccine. The procedure is as follows :

The patient should be inoculated with 200 million organisms for the first dose, double this quantity again 10 days later.[1]

Curative. The treatment of cerebro-spinal fever consists essentially in the intra-thecal inoculation of anti-meningococcal serum, as presently to be described, but in addition it may be given in other ways. The spine may be wet-cupped and an ice-pack applied to the head. Calomel to the extent of 1 gr. may be given as a purge, and phenacetin to the extent of 1 gr. for headache.

The diet should at first be simple and fluid, and the child should be kept in a well-ventilated room, isolated if possible, and darkened if necessary.

Specific Serum Treatment. The success of this treatment largely depends on the promptness with which it is applied. The injections should be given the moment any turbidity of the cerebro-spinal fluid is discovered, without waiting for the bacteriological report, since the serum can do no harm, no matter what be the nature of the infection, and if delayed, valuable time may be lost. The treatment consists in drawing off from 15 to 25 c.c. of the turbid cerebro-spinal fluid, and in replacing it, without withdrawing the exploring needle, by 10–20 c.c. of polyvalent anti-meningococcis serum (B. W. & Co.), that is to say a slightly smaller volume than that drawn off, and this injection should be repeated every 12 hours, alternately by the lumbar and occipito-atlantoid route (cisternal), until the meningococci commence to

[1] This vaccine may be procured from Messrs. Parke Davis & Co. in ampoules of 1 c.c. volume containing 1,000 million organisms.

diminish in number and the fluid begins to become less turbid. If after two injections no improvement is shown in the condition of the cerebro-spinal fluid the agglutination power of the serum should be tested against the meningococcus and if found to be inactive the serum should be changed to one of a different source. The addition of 6 c.c. of fresh sterile human serum (complement) to the anti-meningococcus serum is said to increase its potency. As soon as the meningococcus disappears from smears and cultures, and the fluid itself becomes less cloudy, the intervals between injections may be extended to 24 hours, until the spinal fluid becomes quite clear, that is to say, containing less than 200 per c.c. The serum treatment may then be abandoned.

If the flow of fluid at any time becomes obstructed, the serum should be injected through the fontanelle or an open suture into one of the lateral ventricles, but if the fontanelle and sutures are closed, by lateral trephine openings which may be made in the occipito-parietal region, just lateral to the median line, by means of Goetze's skull borer, and the serum injected into the posterior horn of the lateral ventricle. To test the degree of obstruction between the foramina and the arachnoid spaces, 1 c.c. of neutral phthalein can be added to the serum and injected into the lateral ventricle. The degree of absorption will be shown by the delay in the appearance of the dye in the cerebro-spinal fluid drawn off by lumbar puncture. If it does not appear after 6 hours, obstruction is probably complete. It is a wise precaution before commencing serum injections to perform an intra-dermal sensitivity test (page 414), and if positive, desensitization becomes necessary before proceeding with the full dose of serum.

Poliomyelitis

(Infantile Paralysis; Epidemic Paralysis; Polio-encephalomyelitis; Polio-encephalitis)

This is an acute specific fever due to a filter-passing virus. The disease is notifiable and chiefly affects children between 1 and 5 years of age, but no age is exempt, and even new-born infants are susceptible. There are cases on record in which the infection has been conveyed *in utero*. The incubation period is from 2 to 14 days, generally 2 to 4 days. The spread of infection is by droplet distribution. It is supposed to reach the olfactory bulbs and optic thalamus along the axis cylinders of the olfactory nerves, the terminations of which are infected in the naso-pharynx. The virus or toxin has a special affinity for the nerve cells of the anterior horn of the grey matter of the cord, and especially in the lumbar enlargement, but it may affect the nerve cells in other

situations, giving rise to an encephalitis, as well as to spinal paralysis. The disease takes several forms to which special titles have been given. The following are among the better known:

1. Bulbo-pontine form.
2. Cerebellar-ataxic form.
3. Neuritic form.
4. Meningitic form.
5. Abortive form.

The differential diagnosis has often to be made between poliomyelitis on the one hand and the many varieties of encephalitis, including the influenzal and lethargic forms, on the other. It has also to be distinguished from meningitis of tuberculous or other origin, and from acute rheumatism, scurvy, osteomyelitis and syphilis.

Treatment.

Prophylactic. It is advisable to treat cases of poliomyelitis in isolation for 3 weeks in order to avoid possible spread of infection, which is probably at its maximum in the early stages. Preventive measures against the disease as a whole by serum treatment appear to be less effective than for the curative or preventive treatment of the paralytic after effects.

Curative. During the early or pre-paralytic stages when pain is present, the patient must be kept at complete rest in bed, and the tender muscles protected by means of a water bed and cradle. Later when actual paralysis has supervened, the affected muscles must be kept warm and in a position of complete relaxation to avoid stretching, and consequent deformities such as drop foot. After subsidence of the pain the paralysed muscles may be gently massaged and passive and voluntary movements allowed, but all such exercises must be kept well within the capacity of the damaged muscles. Electrical treatment should be deferred until at least 5 or 6 weeks after the commencement of the disease.

Drugs. As in the case of encephalitis lethargica, I believe hexamine to be of value, but it must be given in really large doses—10 gr. three times a day is not too much to give an infant 1 year of age. Want of faith in this drug is I believe due to the fact that it is generally given in far too small doses. For the relief of pain, 1 gr. of phenacetin given occasionally is in my opinion better than acetyl-salicylic acid (aspirin), but for really severe cases nothing relieves pain so effectually as hypodermic injections of morphia. These must of course be given with caution in the first place, but after a preliminary test of minimal quantity

morphia may be given hypodermically to the extent of 1/30th of a grain.

Specific Serum Therapy. This method of treatment cannot be relied upon to the same extent that it is in other cases of specific infection, and opinion is not by any means unanimous that it is of any value at all, but in my view if the diagnosis can be made confidently in the early stages, the treatment should be tried and convalescent serum selected for preference, although ordinary human serum or even horse serum appears to be of some use. Convalescent serum to the extent of 15 c.c. may be injected intravenously, or larger amounts up to 25 or 30 c.c. intramuscularly.

Sequelæ and Complications. In cases in which the diaphragmatic or intercostal muscles are paralysed, complications which interfere with the mechanics of respiration, the Drinker [1] respiratory apparatus may be employed. The subsequent treatment of the paralysed muscles and the deformities to which they may give rise should be referred for expert advice, in which case the prospects afforded by muscle transplantations, nerve anastomoses, joint fixations, tenotomies, and other orthopædic measures would have to be considered.

Encephalitis

There are several types of encephalitis which affect infants and young children, the most common being encephalitis epidemica (encephalitis lethargica), and the cerebral form of poliomyelitis (polio-encephalo-myelitis). There is however a whole group of cases which are complications or sequelæ of the acute infections, especially measles, diphtheria, mumps, influenza, and typhoid-paratyphoid. That which follows vaccinia has recently provoked a good deal of attention, but in addition to all these varieties, cases occasionally occur sporadically, and even sometimes epidemically (acute meningo-encephalo-myelitis, or acute serous encephalitis), which do not appear to belong to any of these groups, and which occur without any obvious source of exposure to contagion.

While the acute symptoms of all these types are very similar in character, they can usually be differentiated by their history, a possibility which helps in the prognosis, and to some extent in the treatment.

[1] This apparatus may be obtained from Sir Robert H. Davis, 187, Westminster Bridge Road, London, S.W.1.

Epidemic Encephalitis

(Encephalitis Lethargica)

This disease is almost certainly due to a virus which gains access to the nervous system, either by way of the blood-stream, or along the peri-neural lymphatics from the naso-pharynx. There is possibly some relationship between the virus of this disease and that of herpes febrilis. The condition is very difficult to diagnose in the case of young infants, but it is sometimes made easier if a history of exposure to infection can be obtained.

Treatment.

Prophylactic. Beyond the avoidance of known sources of infection, and in this connection the possible existence of healthy carriers must be remembered, and the transfusion of convalescent serum (when such is available) in cases which have been known to have been exposed to infection, little can be done in the way of prevention.

Curative. This resolves itself into :

(1) The treatment of the disease itself in its acute phases.

(2) The treatment of complications, sequelæ, and after effects.

Specific Treatment. As in the case of prophylaxis, the curative treatment mainly depends on the intravenous injection of convalescent serum, if such can be obtained, or in the case of infants under 1 year if the condition can be diagnosed, by ordinary blood transfusions. The injection of Rosenow's anti-streptococcic serum, or Gay's hyperimmune rabbit serum, has been suggested. Methods for producing febrile reactions by fixation abscesses, or by inducing an attack of malaria, have also been advocated. Various antiseptic substances have been given by the mouth, or injected into the blood-stream, but none of them holds out, in my opinion, any reasonable prospect of success.

The only treatment that appears to me to have any practical value is intensive hexamine therapeusis. I have given by the mouth as much as 10 gr. of hexamine three times a day, to a baby under 1 year of age, with definite improvement.

Treatment of Complications. *Sleep.* Disturbances of sleep are common complications, and the habit of sleep sometimes assumes an " inverted " type—that is to say, the child sleeps heavily during the day, and remains awake during the night. These cases are difficult to treat : disciplinary and psychotherapeutic measures are to be recommended.

For sleeplessness, unaccompanied by periods of somnolence, I have found greater benefit from large doses of bromide 10–15 gr.

three times in the 24 hours, than in the administration of duboisine, scopolamine, strammonium, hyascine, and other drugs of the barbituric series which are generally advised for this condition.

For the somnolence, relief of intracranial pressure by repeated lumbar puncture is probably more efficacious than drug treatment.

Delirium. For delirium, other disordered mental states, choreiform movements, and excito-motor manifestations, tincture of strammonium to the extent of 15 minims three times in the 24 hours, is probably the best drug.

Sequelæ and Symptoms of the Chronic Stage. The common symptoms of the later stages of encephalitis are those connected with mental changes, disturbances of sleep, paralysis, the Parkinsonian syndrome, respiratory arhythmia, and oculogyric crises.

The treatment of these manifestations is most unsatisfactory, and holds out little prospect of success.

For the mental symptoms institutional treatment is indicated.

For the physical disabilities consequent on muscular spasticity or paralysis, iodide of potassium in combination with salicylate of soda has been found useful.

Polio-encephalitis

Acute poliomyelitis is now recognized as one of the acute specific fevers, and as such has been included and described in this Chapter. The following varieties of the disease have been classified in accordance with the anatomical lesions in the different parts of the neural axis :

1. The spinal form.
2. The ascending and descending form.
3. The bulbo-pontine form.
4. The cerebral form.
5. The cerebellar form.
6. The neuritic form.
7. The meningeal form.
8. The abortive form.

It is seldom that any one of these types is present in unmixed form, it is generally composite. In its spinal distribution the disease is better known as infantile paralysis, while in its cerebral form it constitutes one of the varieties of encephalomyelitis, from the other varieties of which it is sometimes difficult to distinguish it.

Treatment.

In the treatment of this form of encephalitis the correct diagnosis is of some importance, as the prognosis of polio-encephalitis is more hopeful than in most, and there is a fuller prospect of reward for energetic management. The examination of the cerebro-spinal fluid is some little help in the diagnosis, as in contra-distinction to some other forms of myelitis the fluid shows an excess of proteins and a mononuclear pleocytosis.

Prophylactic. As in all other forms of poliomyelitis, in this also, the intra-thecal injection of convalescent serum, if such can be obtained, has not only a theoretical but also a practical value in cases which have been exposed to infection, and are presumably candidates for the disease. There can be little doubt that this disease is most infectious, but at times it escapes diagnosis owing to the fact that the symptoms are extremely mild. In this connection the danger from carriers must not be overlooked. Neuritic and nervous children of a particular type are liable to take the disease in a severe form, and in the case of such children, when there has been exposure to infection, the need for prophylactic measures is specially called for. If convalescent serum cannot be obtained, in the case of babies at any rate, ordinary blood transfusions appear to have some prophylactic influence. The use of foreign sera, such as an anti-pneumococcic or ordinary horse serum, affords some measure of protection.

Curative. The intra-thecal or intravenous injection of convalescent serum, especially during the early stages, appears to hold out the best prospect of success : 10 c.c. of the serum should be injected after 15 c.c. of cerebro-spinal fluid has been withdrawn. An intra-muscular injection of 15 c.c. of convalescent serum is said to have almost the same value. The use of Rosenow's pleomorphic streptococcic serum has been tried, but is of questionable value. None of these measures is of any use in the later and more chronic stages. Hexamine in large doses (10 gr.) in my experience is worth trying. Lumbar puncture frequently repeated reduces the intracranial pressure, and gives relief to some of the more acute nervous symptoms.

Other Forms of Encephalitis

The encephalitis of measles, vaccinia, and other specific fevers must be treated on the general lines indicated by their special etiology : that is to say, by vigorous treatment of the parent disease by convalescent sera and other procedures described in the sections which deal with them. Lumbar puncture should be

performed in all cases, and repeated as often as it appears to relieve the symptoms.

Tetanus

The matter of tetanus neonatorum has already been referred to briefly in the section which deals with diseases of the new-born (page 155), but tetanus can occur at any age, and usually as the result of superficial wounds of the extremities or exposed parts of the body, which have become contaminated with infected dirt, gravel, or earth.

In the case of new-born infants the disease generally occurs through the severance of the cord with a dirty instrument, or by the application of some infected form of dressing, such as is used by primitive people. Amongst civilized races tetanus neonatorum is now of very rare occurrence, although symptoms of meningitis or meningismus due to sepsis may be mistaken for it. Before treating a case of trismus in a new-born infant as one of tetanus, great care should be taken to confirm the diagnosis, and to distinguish it from brain abscess, birth injury, meningitis, poliomyelitis, tetany, or sepsis. The diagnosis can be confirmed, but only after some delay, by obtaining cerebro-spinal fluid, and injecting it into white rats.

Treatment.

Prophylactic. Great care must be exercised in the antiseptic cleaning up of wounds contaminated with dirt, gravel, or soil.

Specific Immunization. In the case of children who have received a superficial wound which may have been contaminated with horse manure or some other source of the tetanus bacillus, an intra-muscular injection of 1,000 international units of tetanus anti-toxin should be made at the earliest opportunity, after a preliminary test for hypersensitiveness has been performed by the intra-dermal injection of 1/10th of a c.c. diluted horse serum. If no redness results within 30 minutes, absence of hypersensitiveness may be assumed, and the prophylactic treatment proceeded with. The prophylactic injection may be repeated once or twice at intervals of 7 days.

Curative. A child with tetanus should be left undisturbed in a quiet and darkened room, and only fluid foods should be allowed during the acute stages of the illness, to prevent trismus or other disturbances incidental to mastication, or difficulties in swallowing solid food. As sedatives, bromides, chloretone, chloral-hydrate, or hyoscyamus, either singly or in combination may be given.

Specific Treatment. In all cases of tetanus definitely diagnosed,

it is absolutely necessary to use tetanus anti-toxin, which should be injected intravenously, intertherecally, and intra-muscularly, under general chloroform anæsthesia and in the following manner :

1. 10,000 units of tetanus anti-toxin should be injected by cisternal puncture (page 725).
2. 10,000 units should be injected intravenously.
3. 10,000 units should be injected intramuscularly making a total of 30,000 units.

The cisternal and intra-muscular injections should be repeated, but not necessarily under anæsthesia, every day for 3 to 5 days, or as long as the symptoms continue. A preliminary test for hypersensitiveness, as described above under prophylactic treatment (specific immunization), should be undertaken before these curative measures are begun.

Serum Rash. Serum rash is often a troublesome sequelæ of the anti-toxin treatment. It is most effectively treated by the hypodermic injection of 2 minims of a solution of adrenalin (1 in 1000), and by the oral administration of 3 gr. of chloretone, which may be repeated four-hourly as long as the rash and irritation persist.

THE CHRONIC INFECTIONS

Tuberculosis

In this section, as stated generally in the Preface, I shall not make any reference to the symptomology of the diseases dealt with, nor with the courses which they run, and all references to etiology and diagnosis will be reduced to a minimum. Tuberculosis is such a huge subject that many pages would be required if reference to all the various aspects of the disease were made. I shall therefore confine myself in this section almost entirely to the matter of treatment in its prophylactic and curative aspects.

Treatment.

Prophylactic. In this disease there are two great sources of infection, one is milk-borne, the other air-borne. It is generally believed that the type of tuberculosis produced by a milk-borne infection is of a different kind from that which is produced by the human type of bacillus, which is inhaled in the air. It is thought for instance that because the bovine bacillus is swallowed with food and enters the alimentary tract, that abdominal tuberculosis is more liable to develop, and because the human type is inhaled with the air that pulmonary or cervical adenitis is the more probable result. This is not the way in which I regard the

problem. Whether abdominal or pulmonary tuberculosis, or indeed any other form of tuberculosis follows as the result of infection, depends in my opinion on the respective degrees of resistance offered by the different organs in various parts of the body. I only mention these personal opinions because I do not believe that if bovine infection could be entirely abolished, by the elimination of all tuberculous herds, or by other means, the frequency of abdominal tuberculosis would be materially affected.

My own observations show that tuberculosis in infants is mostly of human origin, and that the tubercle bacillus, whether it is inhaled or whether it is swallowed, probably finds its way into the blood-stream and infects the organ of least resistance. Anyhow the prophylaxis of tuberculosis consists in removing infants and children from a tuberculous to a safe environment, or what is perhaps of equal importance, in raising their resistance to infection.

Some authorities believe that the swallowing of the small numbers of bovine tubercle bacilli usually present in milk is calculated to promote immunity, rather than to lead to active tuberculosis for the reason that the bovine bacilli are sufficiently attenuated in virulence not to cause any serious trouble unless they are swallowed in very large numbers, which is not likely to be the case with cow's milk, at least if ordinary degrees of care have been exercised in its production and handling. I must admit that to a certain extent I agree with these views, but all the same I think that there are so many dangers to be feared from unsterilized milk in connection with other infections which may predispose to tuberculosis, that every possible effort should be made to sterilize all milk before it is allowed to be consumed by infants and young children. In view of this opinion I regard the first and most important measure in the prophylaxis against tuberculosis to be the boiling or pasteurizing of all milk.

The second prophylactic measure is the protection of the child against infection by the human type of bacillus, by removal from all known sources of infection—a difficult, one might almost say an impossible task, although it may be feasible to protect him from massive infection. The French method of removing infants from infected environments and boarding them out under the best possible conditions in the country—the so-called " L'œuvre Grancher " system—has undoubtedly had excellent results, but it does not appeal to me as a practical solution of the huge problem presented in our country, partly owing to the expensive nature of the treatment, and partly to the fact that it interferes with the spirit of family life. The segregation of consumptive families

in tuberculous colonies, such as Papworth, has also proved its merits, but here again the question of the expense and the size of the problem has to be faced. The fact that infants and young children survive under conditions in which many tuberculous individuals are segregated together, and where it is obvious in spite of the most careful precautions that there must be endless opportunities for infection, only proves to my mind that the soil is of at least as much importance as the seed, and that you can probably do more to prevent tuberculosis by increasing resistance than by the banishment of the sources of infection.

I believe it is possible to raise resistance by a variety of means quite apart from the artificial immunization of the child, in fact I suppose that every child undergoes some natural form of immunization—goes through, in other words, an unrecognized attack (*forme fruste*), which renders him safe or relatively safe for the future. The strong healthy child survives and becomes immune, the weakling perishes. Resistance can be raised by the general management, as well as by diet, and on these matters I propose now to say a few words.

General Management. As regards general management, one may say definitely that the careful observance of all the recognized principles of sound hygiene, with respect to exercise, rest, sleep, fresh air, sunlight, and the avoidance of vicarious infections, are just as important in the prophylaxis as they are in the cure of the disease. As regards general management, the principles which will be enunciated under the heading of " Curative Treatment " must be understood to hold good in the case of prophylaxis, and they need not be repeated here in anticipation.

With regard to diet, resistance to infection of all kinds is a function of protein metabolism, and for this reason encouragement of an active protein metabolism by a rather one-sided nitrogenous dietary certainly has its application in the case of the prevention of tuberculous disease. For the same reason one-sided carbohydrate or vegetarian dietaries are to be discouraged. Although on general principles I am very much opposed, in the case of perfectly healthy children not greatly exposed to the dangers of massive tuberculous infection, to any breach of the principles of normal dieting, I am very much in favour of eggs, meat, fish, and milk, forming a preponderating proportion of the diet of children unduly exposed to tuberculous infection, or who belong to tuberculous families.

We do not know precisely the rôle which the vitamins play individually, or collectively, in immunity or susceptibility to infection, but it seems certain that vitamin A has important

functions with respect to maintaining the integrity of epithelial surfaces such as those of the alimentary or respiratory tracts, and from this point of view must have some influence on susceptibility to invasion by germs by these routes. Any want of an adequate supply of vitamin A must directly or indirectly predispose to tuberculosis, owing to the fact that it permits of other infections, and the same may be said of the remaining vitamins. Each must be given in definite amount, if conditions of malnutrition which may predispose to tuberculosis are to be prevented.

What is true of the vitamins is also true to a certain extent of all the other accessory factors, including the minerals. If these are not supplied in adequate amount general nutrition is interfered with, and thus the way is opened for tuberculosis. For these reasons regulation of the diet to a physiological and balanced basis must be regarded as a very essential element in the prophylaxis of tuberculosis.

Specific Immunization. Specific immunization by the so-called Calmette-Guerin (B.C.G.) method, that is to say, by the inoculation of tubercle bacilli of low degree of virulence, has already been referred to on page 157 ; but in view of doubts as to the safety of this method, which have arisen owing to the Lübeck tragedy, and other unfortunate experiences in France and elsewhere, it is unlikely that any practitioner would dare to take the risk of adopting this form of prophylactic treatment.

Personally, I have confidence in the general principles underlying the method, but I think that before it can come into general use there must be some better assurance that the type of organism used for the purpose of immunization will retain permanently an attenuated degree of virulence.

I have for many years past practised a method of immunization for infants who are exposed to a dangerous tuberculous environment which has given excellent results, and which I believe is perfectly free from danger. This method of treatment was introduced 30 years ago, in the City of London Hospital for Diseases of the Heart and Lungs, where I had many opportunities for meeting with the right class of case, that is to say, infants of tuberculous parents, who consequently were unhappily potential candidates for the disease. At this hospital and elsewhere I must have treated more than 100 cases. There have been no accidents, and practically no failures. I cannot claim however from this somewhat limited experience that the babies whom I inoculated would have died from tuberculosis if the treatment had not been applied. Negative evidence of this kind is not conclusive, but I feel fairly certain from my general experience that a large pro-

portion of them would have become tuberculous and have succumbed to the disease if the treatment had not been applied.

The cases selected for treatment were infants who were known to be exposed to a highly dangerous environment but who had not so far given evidence of tuberculous infection which could be detected by the ordinary means of physical examination. When it was known that a female tuberculous patient was expecting a baby she was told to bring the child to the hospital as soon as she was allowed to go out of doors. I thus saw the babies at a very early age before any serious damage had been done. The details of the procedure usually adopted were as follows :

As soon after the birth of the baby as was possible, a diagnostic inoculation of 1/8,000 mg. of Koch's Old Tuberculin was injected hypodermically. If the child had already been infected and sensitized by the accidental inoculation of the living tubercle bacillus derived from the mother or her environment, which in the cases suitable for treatment usually occurred within a few weeks of the time of birth, there was a positive reaction, and the prophylactic treatment was then proceeded with.

If on the other hand there was no reaction, after an interval of a fortnight another diagnostic injection was given, and this was repeated at fortnightly intervals until there was a positive response. The positive reaction generally took the form of a rise in temperature, or some other constitutional disturbance, a slight cough, or looseness of the bowels. The precise character of the symptoms gave some indication of the focus of infection.

The prophylactic treatment itself consists in giving weekly injections of increasing amounts of the tuberculin. As a rule the dose was doubled every week until 1/250th mg. was reached, that is in about 6 weeks. From that time onward instead of doubling the dose it was increased by one-fifth, until a dose of 1/100th mg. was reached and then increased by one-tenth, until the maximum dose of 1 mg. The whole course of injections usually took about 6 months, and at the end of that time I considered the child to be immune even to massive infections with the living tubercle bacillus.

On the other hand it is quite valueless as a curative measure in those cases in which the tuberculous process has already reached dimensions which can be recognized by ordinary methods of physical examination. For this reason it is of extreme importance to make the diagnosis by means of a preliminary injection of tuberculin, and begin the treatment while the infant is still young and little damage has been done.

The early diagnosis *intra vitam* of tuberculosis in infants, apart

from that afforded by the hypodermic injection of tuberculin, is peculiarly difficult, and is often missed, as post-mortem records show. Even infants who are seriously affected often remain in an excellent condition of nutrition, but if their temperatures are taken regularly they usually show a morning remission and an evening rise. They sometimes, but by no means always, give a positive response to the Mantoux test, and the same is also true of the Calmette test. The subcutaneous injection of Koch's Old tuberculin, however, followed by a positive response, is to my mind a far more reliable criterion of infection than any other. Moreover, it has the superior advantage of locating the site of the tuberculous process.

Curative Treatment. The curative treatment of tuberculosis in infants and young children involves attention to the following points: rest, sleep, exercise, open-air treatment, the prevention of intercurrent infections, diet, and drug therapeusis.

Some of these matters have already been considered in the section which deals with the treatment of pulmonary tuberculosis (see page 275).

General Management and Nursing. Infants and young children suffering from tuberculosis require fresh air and open-air treatment more than do those who are suffering from any other form of illness. They should be kept in bed under as cheerful and sunny conditions as can be provided. Moving air as a stimulus to metabolism is almost more important than cool air, though the latter is important enough. Damp, hot, and sunless conditions all depress metabolism and are unfavourable elements in the treatment.

Tuberculous infants need not be nursed in isolation. Even "open" cases, that is to say, those with infectious discharges, can be nursed side by side with healthy children if ordinary precautions are taken. Within limits the longer the hours of sleep the better. Too much exercise or movement should be discouraged, but complete immobilization in bed is usually unnecessary. Massage of the limbs and passive movements are often of advantage.

Intercurrent infections, such as measles, whooping-cough, influenza, and septicæmia, act so adversely on the tuberculous process that every effort must be made to prevent their occurrence, or if they take place, to effect a cure as rapidly as possible by the most approved means.

Diet. I have always been greatly opposed to the system of excessive or forced feeding of tuberculous patients which was so popular a few years ago, and which is still sometimes practised.

The active metabolism which the rational treatment of tuberculosis involves can easily be secured without over-feeding. The limitation of exercise which is usually enjoined appreciably restricts the total physiological requirements for food. As in the prophylactic treatment, so in its curative aspects, there is more need for a correct and balanced supply of the accessory factors than for the ordinary fuel foods, but as has already been stated the elaboration of anti-bodies is a function of protein metabolism, and for this reason the nitrogenous elements of the dietary should constitute the preponderating proportion of the total fuel foods. The need for fats is not now so urgent as it was before the days of vitamin concentrates. Both vitamin A and vitamin D can be provided in the latter form, and are better thus administered than as cod-liver oil, or other fats which in themselves are quite liable to disturb digestion.

For these reasons the diet of the tuberculous child should consist largely of meat, fish, eggs, fresh fruit, vegetables, and cereals, with an adequate allowance of Marmite, Bemax, Adexolin, and other vitamin concentrates.

In the case of infants who are still on breast milk, or on the bottle, extra rations of egg, raw meat-juice, Plasmon, Sanatogen, Marmite, and orange-juice should be given.

Drugs. Apart from the treatment of complications, drugs play but a small part in the management of tuberculous cases. There are however two exceptions in which I myself have considerable faith, and which I always employ in treating tuberculosis. These two are :

1. Creosote.
2. Glycero-phosphate of Calcium.

I give both of these in combination with a cod-liver oil emulsion, prescribed as follows :

Glycero-phosphate of Calcium .	1 gr. (0·06 gm.)
Cod-liver Oil	20 minims (1·2 c.c.)
Gum Acacia	a sufficiency
Peppermint Water . . .	to make 1 drachm (3·5 c.c.)

To be made into an emulsion, and given in a dosage of 1 drachm (3·5 c.c.) three times a day for a baby 1 year old.

To each dose of this emulsion I add from 1–20 minims (0·06–1·2 c.c.) of creosote, which should be dispensed in a one-ounce drop bottle. If preferred the creosote may be dispensed by the chemist together with the emulsion, but in my opinion it is advisable to have it as suggested in a drop bottle so that the dosage can be better regulated, and easily increased from day to day. The

initial dose should not be more than one minim, and by very gradual increments it should be increased up to the maximum of 20 minims. I have used this method for the last 30 years and always with the greatest satisfaction.

Medical opinion is not however unanimously in favour of creosote in the treatment of tuberculosis, but as it is practically never given in doses sufficiently large to exercise a really antiseptic action on the infective process, I am not so surprised at this divergence of view as I am that creosote should be employed as frequently as it is. The best results are never attained until the doses are sufficient to cause an exhalation of the creosote in the breath, and until the motions are practically free from fæcal odour. This stage is seldom reached until the individual doses of creosote reach 15 drops in the case of a baby 1 year old, and considerably larger quantities in the case of older children. I have given as much as 1 drachm at each dose to adults although it is generally stated that such doses cannot be tolerated and that even with much smaller quantities indigestion and heartburn are the inevitable results. My experience has not proved this to be the case. Occasionally the urine becomes smoky, and under such circumstances the treatment must be temporarily suspended, but not necessarily abandoned. When the carboluria has disappeared the treatment can be re-started at a lower level.

Specific Treatment. I have long since given up the tuberculin treatment in the case of infants and children for curative purposes. A child suffering from tuberculosis manufactures in its own system much larger quantities of tuberculin than can be given artificially in the form of therapeutic doses. Moreover, the terminal phases of a fatal tuberculosis are almost invariably complicated by secondary infections of pneumococcal, or streptococcal origin, or quite possibly with both. When a child reaches these stages the condition is practically hopeless, and very little can be expected from serological or any other form of treatment. For these reasons I only advise tuberculin treatment as a prophylactic measure.

Sequelæ and Complications. The treatment of the sequelæ and complications of tuberculosis, such as those involving the lungs, the meninges, the kidneys, and lymphatic glands, is described under their respective headings.

Actinomycosis

This is a rare disease in childhood, and almost unknown in infants under 1 year of age. It is due to the presence of one or other of the several varieties of Ray fungus (streptothrix

actinomyces), and is usually mistaken for tuberculosis. It generally attacks the cervical lymphatic glands or tissues in the neighbourhood of the cæcum and appendix. It may be recognized by the chronic course which the disease runs, the marked induration of the affected parts, the tendency to sinus formation, and the character of the discharge, which is greenish in colour and contains pale yellow granules about the size of a pin's head. The diagnosis of actinomycosis can be confirmed by microscopic examination of the discharge which contains the Ray fungus.

Treatment. *Prophylactic.* Since the discharge in an open case of actinomycosis contains the Ray fungus, every person or animal suffering from the disease must be regarded as a potential source of danger. The streptothrix generally enters the system through a lesion in the skin or mucous membrane. A socket of a carious tooth is apparently a favourite avenue of entry. Infection is thought to be conveyed through contaminated stalks or seeds of wheat, barley, or grass. In neighbourhoods where animals are known to be infected, special precautions must be taken in conformity with the knowledge of the means by which infection can be conveyed.

Curative. The general hygienic management of cases of actinomycosis are exactly the same as those for tuberculosis (see page 440).

Local lesions if accessible must be incised and scraped, and the abscess cavities swabbed with some strong antiseptic such as Monsol (1 in 40), or iodized phenol. In refractory cases of long standing, X-ray or radium treatment should be tried.

Drugs. The iodides appear to have almost a specific action in the treatment of actinomycosis. Large doses however are required : for a child 4 years of age not less than 60 gr. a day should be given in divided doses at short intervals. In those cases in which there is any intolerance of this drug, iodine may be given intravenously with the same therapeutic effect, but without any violent reaction. For this purpose 5 minims of aqueous solution of iodine in 1 drachm of physiological solution of sodium chloride, previously sterilized, should be injected intravenously, at not shorter intervals than 24 hours. If by these means hypersensitiveness to the drug is overcome resort may be had later to oral administration.

Syphilis

Syphilis may be acquired by children at any age, directly through contact with patients suffering from the disease, or in-

directly through infected clothing or other contaminated articles. Instances of acquired disease are very rare in childhood. The symptoms of acquired syphilis and the course which the disease runs are the same in children as in the case of adult individuals, but the site of the primary sore is usually extra-genital, and located more often on the face or umbilical region, than elsewhere.

The period of incubation is from 18 to 28 days. Secondary symptoms develop from 3 to 6 weeks later, and tertiary from 2 to 4 years.

The diagnosis from other diseases for which it may be mistaken can be established by the Wassermann test, and from congenital syphilis by the discovery of the primary sore, tracing the source of infection, and from the absence of "snuffles," and other stigmata of the congenital variety.

Treatment. *Prophylactic.* The preventive treatment is only necessary in those cases in which a child is exposed to a known source of infection, as for instance when a person suffering from the disease lives in the same house, or in close propinquity. Under such conditions every possible precaution should be taken to prevent the child coming in contact with contaminated articles, such as clothing, towels, rags, cups, glasses, spoons, etc. On the infected person rests the chief responsibility, and he should take all steps to have the malady treated and cured by the best and most intensive line of treatment.

Curative. The treatment of acquired syphilis in children is exactly the same as that described in the section on congenital syphilis, but the dose of the drugs administered must of course be adjusted to the age of the child. A child 4 years of age should have at least double the quantities prescribed for a new-born infant (page 163).

Rheumatism

Rheumatism is clearly an infectious condition, but whether it should be classified as an acute or as a chronic disease is another question. Further, there is doubt as to whether the causative agent is a bacterium or a virus,[1] possibly it may be due to the symbiotic interaction of the two.

The infectivity of rheumatism must be of very low degree, although other infections, generally of a hæmolytic streptococcal nature, which are associated with the true rheumatic state, or are antecedent to it, may be readily communicable.

[1] Schlesinger, Signy and Amies, *Lancet*, 1935, vol. i, p. 1145.

Rheumatism is not generally regarded as a hereditary disease, although rheumatic families undoubtedly exist. This may be due to the transmission of a particular diathesis or a constitutional susceptibility to the rheumatic poison rather than to environmental conditions.

Rheumatism is said to be rare in children under 5 years of age, and rarer still under 3 years, and almost unknown under 1 year. It seems to me to be probable that this exemption in the case of infants is more apparent than real, because the symptoms which we call rheumatic may take a different form in young children from those with which we are familiar in the case of older individuals.

One of the chief characteristics of rheumatism is the varied character of the clinical picture which is presented in individuals at different age periods. In old age the symptoms are mainly chronic arthritis, chronic fibrositis, chronic spondylitis, and chronic neuritis. We do not often find endocarditis because this manifestation of rheumatism has in all probability already killed its victims. In early adult age the symptoms take the form of acute arthritis, chronic endocarditis, acute spondylitis, acute fibrositis, acute neuritis, conjunctivitis, iritis, and inflammation of other tissues. In children the rheumatic manifestations are mainly those of tonsillitis, acute endocarditis, pericarditis, myocarditis, commencing spondylitis,[1] fibrous nodules, headaches, irritability, night terrors, so-called " growing pains," and chorea. But in infants, what are the characteristic symptoms ? " Aye, there's the rub." What are they ? I can only suggest that the rheumatic state in infants is represented by a condition of bacteriæmia (endocarditis is far more common than is usually supposed), by streptococcal infections of the bowel, nervous irritability, spasmophilia, and acidosis. Infants have not lived long enough to have acquired that allergic susceptibility to the rheumatic poison which stamps itself on the true rheumatic subject. Some authorities get over this difficulty by propounding the hypothesis that there is such a thing as a pre-rheumatic stage, characterized by a variety of constitutional symptoms, such as aches and pains, general feeling of tiredness, loss of appetite, slight pyrexia, etc., which owe their existence to repeated small infections, but are not themselves sufficiently typical to be called true rheumatism. Whether this is so or not it appears fairly certain that before a major attack of rheumatism develops there is nearly

[1] S. Gilbert Scott believes that rheumatism can be diagnosed at an early age in young children by the presence of commencing spondylitis as shown in the X-ray picture.

always a history of minor infections, generally of the hæmolytic streptococcal type.

As for the etiology of rheumatism, all authorities are agreed that the greater proportion of its victims are to be found in the poorer sections of the community. It is also generally agreed that cold and damp, whether due to climatic, telluric, housing, or clothing conditions, play a large part in its causation. Further, unhealthy conditions of the tonsils, of the teeth, or of the bowel, giving rise to repeated minimal doses of rheumatic poison, finally culminate in a major attack.

Treatment.

Prophylactic. The prevention of rheumatism must be based on what is known, or thought to be known, of the etiology of the disease; this mainly involves protection against cold and damp, and the early treatment and cure of infective or debilitating illnesses, especially those connected with septic tonsils, carious teeth, and unhealthy conditions of the bowel. It is generally recognized that antecedent to the development of the true rheumatic state, there is a pre-rheumatic phase in which the child suffers from a variety of symptoms, which though not pathognomonic individually, nevertheless collectively make up the clinical picture of rheumatism, which is not easily mistaken, and which if treated in time may be prevented from developing into more serious conditions. One may assume that in the pre-rheumatic state the child is gradually losing its power of resistance or becoming hypersensitive (allergic) to the causative agent. When the premonitory symptoms which have already been described are noticed, every effort should be made to bring about some improvement in the general health by attention to details of hygiene, and the cure of any discoverable focus of infection.

Apart from climatic, housing, clothing, and other conditions which may be responsible for the production of chill, and the lowering of resistance, there are three main considerations which require attention : (1) Feeding. (2) Prevention of oral sepsis. (3) Prevention of intestinal intoxication and unhealthy conditions of the bowel.

Precaution against damp includes the adequate drying of clothes, boots, bedding, etc. It is quite astonishing what a large amount of moisture blankets, sheets, underclothing, etc., can hold. Clothing that may appear perfectly dry will steam freely for some minutes if held close to a hot fire. I feel sure that absolute freedom from dampness in clothing, bedding, etc., is one of the most important of the prophylactic measures against rheumatism.

As for clothing, cellular varieties of material, such as Aertex, Airlin [1] or Meshlin [1] are in my experience superior, especially if worn in duplicate, to the ordinary merino or woollen underwear, for the prevention of chill due to absorption of moisture. It should also be remembered that hot-water bottles, or even the old warming-pan, do not get rid of moisture—they warm but do not dry. Further, I strongly recommend the insertion of cork soles into boots and shoes; they can be taken out at the end of the day and thoroughly dried.

As for feeding, a well-balanced dietary with avoidance of excess of meat, fish, and eggs, that is to say, a low protein diet, with a plentiful supply of fresh fruit, vegetables, and cereals, are the chief requirements. Over-feeding is a prolific source of intestinal toxæmia, and as such a predisposing factor in the production of rheumatism or the pre-rheumatic state. Vitamin deficiency certainly lowers resistance to infectious diseases and predisposes to acidosis and for this reason care must be taken to supply adequate quantities of this class of accessory factor by selecting foods in which vitamins are well represented, or by the giving of concentrates such as halibut-liver oil, yeast preparations, Bemax, Marmite, and orange-juice.

Curative. The curative treatment of the acute attack necessitates keeping the child in bed, and feeding him on a simple, light diet, consisting mainly of milk, cereals, fruit, and vegetables. Meat, fish, eggs, and other protein foods should be reduced to a minimum.

With a painful arthritis the joints should be encased in capsicum wool (B.P.C.). Should there be excessive sweating, frequent changing of the sleeping apparel and bed clothes is essential.

Drugs. Although from time to time new drugs are introduced which claim to have a specific action on rheumatism, it may be confidently assumed that none is better than the old salicylate of soda. With the giving of this salt it is always enjoined that large quantities of alkalies should be combined with it to correct the acidosis to which this treatment may give rise. As a matter of fact it is very doubtful whether the acidosis found in such cases is due to the drug. It is part of the disease, and a very important part, which must be treated appropriately with large doses of bicarbonate of soda and citrate of potash. I feel sure it is safer to use a combination of these two alkalies rather than to give either singly.

[1] The Irish Linen Mesh Company, Ltd., Rydalmere Street, Belfast, N. Ireland.

The following prescription will serve for a child 4 years of age :

Salicylate of Soda	5 gr. (0·3 gm.)
Bicarbonate of Soda	7 gr. (0·42 gm.)
Citrate of Potash	7 gr. (0·42 gm.)
Simple Syrup	½ drachm. (1·75 c.c.)
Cinnamon water	2 drachms (7 c.c.)

To be given every 4 hours.

The bowels should be kept well open with a saline aperient, such as the effervescing artificial Karlsbad salt (B.P.C.) to the extent of ½ drachm in about 2 oz. of water.

The treatments of special complications, such as endocarditis, tonsillitis, and chorea, are described under their respective headings. Special care should be devoted to convalescent treatment since relapses are frequent. The particular measures that should be taken are described under " Prophylaxis "

Malaria

Malaria is due to the presence in the body, or in the blood, of one of three forms of protozoal parasite, namely

1. Plasmodium vivax,
2. Plasmodium malariæ,
3. Plasmodium falciparum,

giving rise respectively to tertian (benign), quartan, and subtertian (malignant) varieties of the disease.

The parasite is conveyed to the body by anopheline mosquitoes, which are themselves infected through sucking the blood of affected persons.

Malaria of local origin is practically unknown in Britain, although occasionally sporadic cases imported from abroad are met with. The incubation periods of the different varieties of the disease vary slightly, but on an average they are from 10 to 14 days.

In the case of children in this country, malaria runs a somewhat atypical course, with pronounced gastro-intestinal symptoms, convulsions, pyrexia, dehydration, and ultimately enlargement of the spleen. The differential diagnosis lies between influenza, typhoid, paratyphoid, bacillary dysentery, miliary tuberculosis and rheumatism. The diagnosis of malaria can be confirmed by the discovery of the plasmodium in the blood, a task which should be left to an experienced pathologist.

Malaria can occur at any age, even in very young babies, but it is questionable whether there is such a thing as congenital malaria, or whether it is possible for the parasite to reach the

fœtus through the placenta, but it is regarded as probable that the fœtus can be damaged, or indeed killed with resulting abortion, by a toxin generated by the plasmodium in the mother's body. Moreover, living infants born to mothers suffering from the disease are often delicate and debilitated. They present symptoms which have to be distinguished from those of actual malaria. I have on several occasions been confronted with the problem of deciding whether such debilitated infants owed their condition to an existing malaria, or simply to the toxic effects of the malarial poison affecting the fœtus *in utero*. The diagnosis is by no means easy, and repeated negative blood tests may not satisfy the mother that the child is not suffering from genuine malaria and thus standing in need of specific treatment. Occasionally a debilitated and degenerate baby, born to a mother suffering from malaria, may owe his condition to the toxic effects of the quinine with which the mother has been drugged. Quinine itself is an ecbolic of some potency, but short of producing abortion it may reasonably be supposed to damage the fœtus *in utero*. The taking of large quantities of quinine for prolonged periods by malarial mothers can also act prejudicially on the germ plasm, leading to the birth of an inferior class of infant. To this blighting influence of quinine the name of " Blastophthoria " (*blastos* = germ, *phthora* = corruption) has been given, as it has to damage inflicted on the germ plasm by toxins in chronic alcoholism, syphilis, tuberculosis, and plumbism.

Treatment.

Prophylactic. Domestic measures of preventing the disease include the use of mosquito-nets in malarial districts, and the mosquito-trapping method recommended by J. F. James.[1] Attempts at immunization by the prophylactic use of quinine is recommended by some but discouraged by others. Personally I am not in favour of it. I often think that more harm is done by the giving of large doses of quinine than by the malaria itself.

Local or municipal measures against malaria include the draining of swamps, the filming of stagnant water with petroleum, and the stocking of ponds with Gambusia, a species of minnow, which feeds on the anopheline larvæ.

Curative. During the acute stages of the disease and for as long as the pyrexia lasts, the child should be kept in bed and made as comfortable as possible in conformity with the various stages of shivering, sweating, and fever, through which the disease passes.

[1] JAMES, J. F., *Ind. Med. Gaz.*, 1935, lxx, March, p. 145.

If gastro-intestinal symptoms predominate, Benger's Food or peptonized milk may be employed as long as the sickness or diarrhœa lasts.

Drugs. Although a bismuth and opium mixture (page 693) may be given in cases of alimentary disturbance, the only drug which until recently was known to have any specific influence on the disease is quinine. At the present time the choice lies between this old-established line of treatment, and the newer drugs—atebrin, a synthetic alkyl-amino-acridene derivative, and plasmoquine, a quinoline derivative, or quino-plasmoquine, a combination of quinine sulphate and plasmoquine.

Of the many quinine salts available, such as the sulphate, hydrochloride, hydrobromide, and the acid hydrobromide, all of which have their advocates, it is somewhat difficult to say which is the best. Whatever salt however is used, it is universally agreed that the treatment must be continued for 8 to 10 weeks, or the system will not be cleared of the parasite, and relapses will occur.

For the benign or tertian form of the disease, I advise the administration of acid hydrobromide of quinine by the mouth, and to the extent of 1 gr. three times a day, for an infant 1 year of age. This treatment must be continued for 1 week, to be followed by the administration of about half the above dose for the next 8 weeks. The drug may be given in milk, which is the simplest and easiest method, or disguised with syrup of orange. For older children considerably larger doses must be given.

For the malignant tertian form, it may be well to combine intra-muscular injections with the oral administration of the acid hydrobromide of quinine. For this purpose 1 minim of the hydrobromide solution of acid hydrobromide of quinine (Injectio quininæ hydrobromidi acidi hypodermica) should be injected intra-muscularly once a day, and 1 gr. of the same salt given twice daily by the mouth for 1 week. This should be followed for 6 or 8 weeks longer by oral administration of about half this dose.

Atebrin (Bayer) is specially indicated in cases of quinine intolerance. It was largely used, and with success, in the recent outbreak of malaria in Ceylon. It may be given alone, or with plasmoquine. The method is as follows : 1 gr. of atebrin and 1/16th gr. of plasmoquine should be given daily for 5 to 7 days, followed by a course of plasmoquine in 1/10th gr. doses, every 3 to 5 days without the atebrin.

In very severe cases of malignant tertian malaria, 1 minim of atebrin musonate, which is a soluble salt of atebrin, may be

injected intra-muscularly once daily, for 3 days, followed by a course of treatment with 1/10th gr. of plasmoquine given by the mouth, and continued for 3 to 4 days.

Weighing up the respective values of these different methods, I am inclined to advise, for the present at least, adherence to the old quinine method of treatment, and for choice the oral administration of the acid hydrobromide of quinine, excepting in those cases in which there is a definite hypersensitiveness to quinine, in which case the atebrin and plasmoquine treatment is preferable.

Coli Bacillus Infections

Diseases due to the Coli bacillus are just as much blood infections as, for instance, sepsis or rheumatism, but they are not generally included in the usual classifications of infective diseases. They are very common in babies and young children, but by no means always with urinary symptoms; although in practically all cases the organism can be isolated from the urine. This is because Coli bacilli are eliminated from the blood by the kidneys.

The gall-bladder is a frequent seat of Coli infection, and so is the middle ear, and the cerebro-spinal fluid. Abscesses, discharges, and fluids containing Coli organisms, generally, but not always have an unpleasant odour by which they can be detected. Coli organisms are always present in the alimentary tract, but there appear to be many different varieties, each possessing a different degree of virulence.

Under certain circumstances this normal constituent of the bacterial flora of the bowel changes its condition as a harmless saprophyte into one of dangerous parasitism and when this is the case it can invade the tissues and lead to a general blood infection, but it is not definitely known what are the required conditions for such a result to ensue. One of them however seems to be an unhealthy condition of the bowel, such as a mucous colitis, but there are two other conditions which are very closely associated with general Coli infections, and these are

1. Acidosis.
2. Teething.

Whether acidosis produces Coli infections, or *vice versa*, or whether both conditions are due to some common cause, is unknown. But what appears to be quite certain is that in the majority of cases, if you can cure the acidosis and render the urine alkaline, the Coli bacillus disappears from the urine, although it is quite impossible to produce a degree of urinary alkalinity sufficient to kill the organisms. The cure cannot be due to the lethal influence

of the alkali. The association of dentition with Coli infection is difficult to explain, unless it be that the general disturbance to health with which the cutting of the teeth is often associated may possibly lead to a lowering of resistance to a bacterial infection and invasion.

Treatment.

Prophylactic. In the prevention of Coli infections there are two paramount necessities, both founded on the above-mentioned etiological associations. One of them is to keep the bowels in a healthy condition, and the other one is to prevent the development of conditions of acidosis. Constipation is not in itself a cause of pyelitis, or of any other form of Coli infection. Constipated motions contain a large number of dead organisms, but not many living ones. Moreover, in constipation the bowel-wall is often covered with dried plaques of mucus that interfere with absorption. Liquid motions on the other hand constitute a highly suitable medium for the multiplication of all forms of organism, including the Colon bacillus, and a dose of castor oil definitely increases the number of Coli organisms excreted by the kidneys and found in the urine, owing to the loose condition of the bowels, to which the administration of this drug disposes. This result so invariably follows, that a dose of castor oil has been used as a test to see whether a Coli infection of the urinary tract has been completely cured. If no bacilli appear in the urine after the administration of this aperient, it is assumed that the infection has cleared up. The best test for acidosis in infants and young children is the presence of a strong smell of ammonia in soiled napkins.

Since all degrees of acidosis either favour the development of Coli infections, or indicate the probability of such arising, infants and young children who have already been the subject of a previous attack of pyelitis should be watched very carefully for this preliminary sign, and the acidosis treated as soon as it is discovered. For this and other reasons every effort should be made to keep the intestinal tract in as healthy a condition as possible, with neither looseness of the bowels nor constipation. To effect these objects there is to my mind nothing better than the regular administration of petroleum in the form of an emulsion, such as Semprolin (50 per cent). A small dose given at each meal is better than one large dose given at night-time. This method keeps the whole of the alimentary duct well lubricated, which is not likely to be the case when a single dose is given. Intestinal antiseptics are as a rule unsatisfactory, unless they are given in such large doses as to cause irritation of the mucous

membrane of the bowel. But in refractory cases the creosote method (pages 441 and 696) may be employed and relied upon to produce a fairly satisfactory antiseptic influence. One way of securing disinfection of the alimentary tract and to change the bacterial flora, is that of introducing a culture of lactic acid organisms in the form of sour milk, Lactobacilline, or Lacteol.

Curative. In the treatment of pyelitis or a Coli bacilluria, or indeed any other form of Coli infection, it must be remembered that the object is not so much to kill the bacillus in the urine as to cure the conditions which give rise to the increased virulence of the organism. In healthy animals large doses of Coli organisms injected intravenously can be tolerated without producing any symptoms, and in a few hours they are eliminated from the blood and found dead in the urine. The same sort of result may occur in the case of children, that is to say, under healthy conditions Coli organisms cannot exist in the blood. Under pathological conditions they may become virulent and escape through the bowel-wall into the blood. For these reasons, in the curative as in the preventive treatment, the object must be to restore the body to a condition of health, and one inimical to the existence of Coli organisms of pathological degrees of virulence. With these objects in view attention must be paid to the condition of the alimentary tract by dietetic means and drug treatment. All conditions of acidosis must be treated, and the urine kept alkaline by sufficient doses of bicarbonate of soda and citrate of potash It is better to give these two alkalies in combination than either singly.

Hexamine is supposed to have a specific action on the Coli organism in the kidney, pelvis and bladder, owing to the antiseptic action of a phenol element in its molecular structure. For the liberation of phenol in the urinary tract it is necessary that the reaction of the urine should be on the acid side of neutrality ; if the urine is alkaline no phenol is liberated. For this reason a combination of intensive alkaline treatment with that of hexamine cannot be relied upon in Coli infections. I find that the best method of employing these drugs is to use them alternatively for a week at a time, the hexamine being given with acid phosphate of sodium, and then to substitute for this a combination of alkalies without the hexamine. Hexamine should be given in far larger doses than is usually prescribed. I do not hesitate to give a baby 1 year old 5–10 gr. of either three times a day.

Specific Treatment. The specific treatment of Coli infections by vaccine therapy does not appeal to me on rational or theoretical grounds. Moreover, I have never had in practice any particular

success with it, though I have seen it tried on many occasions. On the other hand, satisfactory reports have been made on the use of convalescent or ordinary blood serum, but this again does not appeal to me as a very helpful line of treatment, unless unhealthy conditions of the bowel and other sources of acidosis are dealt with at the same time. In the few cases I have tried I have had great success with the oral administration of Prontosil (page 699), and I strongly advise this treatment in refractory cases.

CHAPTER XIV

DISEASES OF THE SKIN

The skin of babies and young children is at all times and under all circumstances extremely vulnerable and sensitive. This is more particularly true of the skin of the new-born baby, which at the time of birth and for some time afterwards is in a soft and macerated condition, owing to the fact that it has been soaking in amniotic fluid for many months. The reactions of the skin to the stimuli of the environment are essentially conservative or protective in character, that is to say, they subserve the interests of the organism as a whole. For instance, red cheeks or a temporary flushing of the skin represents a physiological reaction in response to excessive heat production in the body. The blood by being brought to the surface and coming in contact with cooler atmospheric conditions loses heat and adjusts the balance between production and loss. Contrariwise, pallor of the skin or cold extremities are both conservative reactions whereby the blood is withdrawn to the interior of the body, when it is in danger of becoming chilled at the surface.

The inflammatory reactions of the skin may take the form of abscesses, papules, vesicles, bullæ, and many other kinds of blain or sore, which develop in response to mechanical, chemical, or bacterial stimulation. In the case of infants and young children, these protective reactions are often of a violent character. No part of the skin, whether surface epithelium, corium, sweat gland, sebaceous gland, hair, or nail, is exempt from injurious stimulation, either from without or from within, but the exact form which the reaction takes will depend on a variety of circumstances, for example, the nature of the stimulus itself, or the duration of the attack, and on the inherent qualities of the skin itself. A great deal however can be done to protect the skin of babies from these injurious agencies by forethought and careful management; in fact skin diseases are easier to prevent than to cure.

Since most of the diseases of the skin are due to mechanical, chemical, or parasitic irritation, prevention is mostly concerned in protecting the skin from exposure to these sources of injury.

From the practical point of view the most effective means of preventing damage to the skin is to keep it dry, and the next to save it from friction or other injuries which may cause breaches of continuity in the epithelium surfaces through which bacteria can enter and form foci of infection. The folds of skin on the abdomen, neck, thighs, and wrists, and other intertrigenous areas in fat children, which are difficult to keep adequately dry, are favourable sites for inflammatory reactions. So too is the skin over the buttocks, which is exposed to the constant irritation of wet and soiled napkins, and also to the friction which is often too zealously exercised by the nurse in attempting to remove adherent fæcal matter by sweeping movements with a clean part of the square. Frequent bathing and application of soap and water is not good for the skin until it has become sufficiently hard to stand injurious attentions of this kind. After the initial bath, it is wisest not to give the newborn baby any further ablutions of this kind until the cord has separated. This length of time is sufficient in most cases for the skin to become resistant. Respect for surface epithelium, and very gentle handling and prompt removal of moisture, as well as the free application of a good dusting powder consisting of talc, are the main essentials in preventing diseases of the skin in young babies. The belief that the application of a nursery powder to the skin stops up the pores of the sebaceous and sweat glands and conduces to acne, or other skin trouble, is ill-founded. A good powder keeps the skin dry and prevents friction and the small lesions through which bacteria enter.

SIMPLE ERYTHEMA

A simple erythema is a redness of the skin which is capable of being blanched by pressure. The commonest example is that met with in the napkin area in the form of sore buttocks. It may occur however in any part of the body which is exposed to the irritation of clothing, dampness, heat, etc., which is sufficient to cause vasomotor reactions without setting up any actual inflammation.

Sore Buttocks

Although as a rule sore buttocks take the form of a simple erythematous rash, or reddening of the skin, the reaction sometimes passes beyond this stage and leads to definite inflammation or actual ulceration. There are several varieties of sore buttocks,

which though not all of the nature of a simple erythema, may be conveniently described here.

They may be due to :

(1) Irritation from strong or acid urine.
(2) Irritation from fæcal material.
(3) Irritation from ammonia gas.
(4) Ulceration due to urticaria.
(5) Ulceration due to herpes.
(6) Syphilis, or syphilitic discharges from the anus.

(1) Soreness of the Buttocks due to Urine. This variety of sore buttocks is due to an unduly acid condition of the urine, or to negligence in changing the napkin sufficiently often. The rash is for the most part confined to the anterior part of the napkin area, the scrotum and inside of the thigh, the penis, in males and in corresponding parts in females. The urinary rash does not as a rule extend to the posterior areas of the buttocks, but it may coalesce with a rash in this situation due to fæcal irritation or other causes.

Treatment. *Prophylactic.* The best way to prevent this condition is to train the infant to pass water when held out, or if such training has not been successful, by the prompt changing of soiled napkins. Hardening of the skin by applications of tannic acid in alcoholic solution (1 in 8), its protection by the free use of dusting powder, and the gentle handling of the skin in washing and drying, are all prophylactic measures of great value. The avoidance of all those causes which lead to acid states of the urine, or the correcting of the latter by sufficient doses of alkali, are also precautions which should not be neglected.

Curative. The cure is promoted by the employment of all those procedures which are enumerated under prophylaxis, and in particular the urine must be rendered less acid, or actually alkaline by the administration of sufficient doses of sodium bicarbonate and potassium citrate. Five grains of each three times a day will as a rule be found not an excessive dose.

Local applications may take various forms, but in my experience none is better than tannic acid and alcohol (1 in 8). This should be freely dabbed on the affected tissues every time the infant is changed and should be allowed to dry before the napkin is readjusted. Free applications of dusting powder are also indicated.

(2) Sore Buttocks due to Fæcal Matter. This condition is generally due to the irritation of strongly acid stools, but sometimes it is due to the frequent passage of stools which may be

actually alkaline. The area of soreness is confined to the posterior parts of the buttocks round the anus which come in contact with the fæcal material in the napkins. These rashes often co-exist with an erythema of urinary origin, in which case the distribution of the rash is a combination of the two varieties.

Treatment. *Prophylactic.* The baby should be trained to the use of a porringer. The application of the rim of a porringer to the buttocks may serve as the eliciting stimulus for the act of defæcation. If possible, infants should be taught to open their bowels at regular times night and morning. If the stools are loose or strongly acid, the condition should be treated by large doses of prepared chalk ; 10 gr., or more, every 3 hours is a suitable dose. Calcium given in this way reaches the lower part of the bowel and unites with fatty acids to form insoluble and non-irritating soaps. This method of treatment is far more efficacious than the giving of bismuth or astringents such as catechu or hæmatoxylin.

Local treatment should take the form of the careful removal of fæcal matter by means of a sponge and warm water, and by very careful drying by dabbing, followed by the application of tannic acid in alcohol (1 in 8). This treatment is more effective than the application of an ointment consisting of castor oil and zinc. This salve tends to soften rather than harden the skin. In very bad cases, no napkin should be applied, and the buttocks should be exposed to the air by allowing the child to lie on its abdomen for at least part of the day. If the tannic acid method is employed the skin usually recovers rapidly and obviates the necessity of continuing the above somewhat drastic procedure for more than a few days.

(3) Sore Buttocks due to Ammonia Gas (*Napkin Rash*). The term " Napkin Rash " should be reserved for this particular variety of sore buttocks, for it is the only one in which the rash takes the exact shape of the napkin. This soreness is not due, as is often claimed, to the presence of soda in the napkins, but to free ammonia gas which remains pent up under the diaper and irritates the whole area covered by it. When the napkin is removed there is a strong smell of ammonia which irritates the eyes of the attendant and causes free lachrymation. The liberation of ammonia under the napkin is due to the dissociation of ammonium salts by soda, warmth, exposure to the air, or mere contact with the napkin. Such decompositions only cause trouble when there is an excess of ammonium salts in the urine. It is not due, as has been supposed, to the decomposition of urea by fæcal bacteria. I have in my possession, and keep as a curi-

osity, a leaflet of printed directions, which describes how napkin rash can be avoided by washing the squares in perchloride of mercury, which acts as an antiseptic, kills the bacteria present in the fæces, and thus prevents them from decomposing the urea in the urine. This form of optimism resembles that of " tickling the dome of St. Paul's to please the Dean and Chapter."

The reason why ammonium salts are present in excess in the urine is because of the co-existence of a condition of acidosis in which ammonia is liberated from urea in the kidneys. This free ammonia neutralizes *in situ* the excess of acid which is generated in those conditions of abnormal metabolism which are associated with acidosis, and produces a urine which readily yields up free ammonia on exposure to the air.

The cure therefore of napkin rash is the correction of the underlying disorder—" Acidosis " by giving alkalies by the mouth, and not by washing residual soda out of the napkins. It hardly ever occurs in babies under 6 months of age, but is particularly common during the period of teething.

Treatment. *Prophylactic.* This is extremely simple and consists in supplying sufficient alkalies by the mouth to render the urine alkaline, thus obviating the necessity for the production of ammonium base in the kidney. If the underlying cause or causes of the acidosis itself can be discovered these must be treated also.

Napkin rash is a self-limiting disease. It effects its own cure by rendering the skin hard and brawny. But the same cannot be said of the acidosis itself, to which the excess of ammonium salts in the urine is secondary. The acidosis must be treated on appropriate lines, or it will lead to other and possibly more serious consequences.

Curative. The cure of napkin rash proper, is as simple as its prevention. It depends on the treatment of the acidosis by alkaline medication. Sufficient bicarbonate of soda and citrate of potash must be given to render the urine alkaline and free from ammonium salts. The quantity required is sometimes very great. I have known cases in which as much as 3 drachms of the combined salts have had to be given in the 24 hours before the required object was attained.

The skin itself very rarely requires local treatment. If it does, the astringent treatment which is indicated in other forms of sore buttocks is usually all that is necessary. The best treatment for more serious degrees is to apply a free coating of dusting powder or calamine lotion in sufficient quantity to protect the skin from contact with the irritating gas.

(4) Sore Buttocks due to Urticaria (*Lichen Urticatus, Red Gum, Strophulus, Teething Rash*). This form of sore buttocks is very common, especially during periods of teething or when urticarial rashes are present on other parts of the body. It is not altogether unlike the herpetic form, but the papules do not follow the distribution of the sensory nerve filaments, and they are more discrete, often forming a sort of grid-iron pattern on both sides of the buttocks. In the early stages the general appearance of the spots is the same as that of urticaria in other situations (see page 491), but owing to the almost inevitably unclean condition of the skin in the napkin area, the papules or vesicles soon become purulent and ulcerated. The ulcers are often quite deep, punched out, and intractable to treatment. They have to be distinguished from the punched-out and serpiginous ulcers of syphilis.

Treatment. *Prophylactic.* The prevention of urticarial rashes on the buttocks is the same as that for other forms of urticaria. It is however in my experience more often associated with teething than with any other of the recognized causes of urticaria. The nature of the prophylaxis will however depend largely on the primary cause of the urticaria itself.

Curative. The general treatment must be on the lines advised for urticarial rashes in other situations (see page 494). The local treatment consists in keeping the parts as clean and free from fæcal contamination as the conditions allow. When the rash is in the papular stage the spots should be coated with collodium or some other protective varnish, such as compound iodoform paint (page 702). If the papules or vesicles become purulent or broken, an antiseptic ointment, such as Antipeol or dilute ammoniated mercuric ointment, should be applied.

(5) Sore Buttocks due to Herpetic Eruptions (*Herpes femoralis ; Herpes recurrens*). Herpetic eruptions of the buttocks are by no means uncommon. They assume the same general characteristics as herpes in other situations, but owing to contamination with fæcal matter the vesicles soon become purulent, break down, and leave punched-out serpiginous depressions not altogether unlike those due to syphilis. The eruption is often confined to one buttock, which makes the diagnosis simple. The distribution usually corresponds to the nerve filaments of the first and second lumbar nerve roots. The belief is gaining ground that herpes recurrens is due to the infection of an ultra-microscopic virus, which normally assumes a semi-saprophytic existence on the mucous surfaces of the nose and elsewhere, but which under certain conditions acquires pathological significance.

Treatment. *Prophylactic.* It is possible that an attack may be aborted in its initial stages by giving ½ gr. of quinine or 4 gr. of hexamine every 4 hours. In view of the likelihood that a virus is the cause of the trouble, the existence of possible "carriers" must be taken into consideration.

Curative. The treatment of the condition depends a good deal on whether the herpetic spots have become vesicated and broken down, or whether they still maintain the papular form. If the latter is the case, they should be protected with collodium or some suitable varnish, such as compound iodoform paint (page 702). If the papules have become ulcerated or broken down an antiseptic ointment such as Antipeol (page 701) should be applied.

(6) Soreness of the Buttocks due to Syphilis. Sore buttocks from the above cause takes two forms: it either consists in a somewhat widely diffused rash over the whole of the buttocks, and possibly over other parts of the body also, or as a local soreness round the anus which depends on the irritation of secretions from condylomata.

(a) Generalized Syphilitic Rash. This rash generally takes the form of flattened papules which at first are red in colour, but later on acquire a coppery tint. The rash is widely distributed, but shows special affinity for the thighs, external genitals, and buttocks. The papules usually become ulcerated owing to contamination with fæces, and coalesce in a serpiginous outline. The ulceration is especially liable to occur in the moist flexures, and it usually begins about the same time as "Snuffles"—that is to say—towards the end of the 1st month.

Treatment. *Prophylactic.* The prevention of this condition is the prevention of the primary disorder (page 162).

Curative. Apart from the general specific treatment for syphilis, the local treatment of this rash consists in keeping the area of its distribution as dry as possible by means of free dusting with a good talc powder. If ulceration has already taken place, an antiseptic ointment such as Monsol 10 per cent should be applied, or dilute ammoniated mercury ointment, but if this is done care should be taken not to overdo the dosage of mercury especially if the latter is being administered simultaneously in any other form.

(b) Condylomata. Condylomata of the anus usually occurs in the acquired rather than in the congenital form of the disease and unlike the rash previously mentioned, they occur late, generally about the 3rd year. Condylomata arising from the anal ring usually pour out a copious irritating discharge which tends to cause considerable peri-anal inflammation.

Treatment. *Prophylactic.* The preventive treatment of this condition is the prevention of the primary disorder.

Curative. Apart from the specific treatment of the primary disorder, local treatment depends on keeping the parts clean and dry. After the passing of a motion, the anus and surrounding parts should be thoroughly washed with warm water, carefully dried, and then freely dusted with a powder consisting of 1 part of calomel in 10 parts of talc. If the condylomata become ulcerated they should be treated with dilute ammoniated mercury ointment (page 701). The condition is highly infectious.

Chilblains

(Erythema pernio)

Chilblains are a localized variety of an exudative erythema, limited to the extremities of predisposed subjects. They are produced by cold and have to be distinguished from frostbite and tuberculides.

Treatment. *Prophylactic.* The surest way of preventing chilblains which may become exceedingly tiresome in the case of susceptible children, is by climatic treatment. I have on several occasions recommended children suffering from this condition to winter in North Africa or the Canary Islands, with great success. This form of treatment is naturally impossible for the majority of children, and in their case the feet and hands should be as well protected as possible during cold weather, by the wearing of double socks and double gloves. During the winter months ultra-violet light treatment combined with ultra red, is definitely prophylactic, and lactate of calcium should be given in doses of 5 gr. three times daily.

Curative. All the procedures which are recommended above as prophylactic should be employed also to effect a cure. Good feeding with special reference to vitamins and mineral elements is also helpful. As for local treatment, if the skin is not broken the affected parts may be well rubbed with Parke Davis's Stimulant Embrocation (page 708), or Caprolin Cream (page 702). Electricity may also be employed. This is best done by immersing the hands or feet, as the case may be, in two bowls of water, in which are placed the electrodes of a galvanic battery which supplies a current of 2–4 milliamperes. This treatment should be given daily for 10 months. If the skin is broken, Granulogen paint (page 708) should be applied, or some simple antiseptic ointment such as acriflavine cream (page 702).

Erythemas of Transitory Duration and Due to Infective Fevers

Most of the acute infective fevers, including sepsis and cerebro-spinal meningitis, are accompanied by some form of erythematous rash. The differential diagnosis is often very difficult.

Treatment. The general treatment of these rashes, both prophylactic and curative, is the treatment of the primary disease.

Local treatment to assuage the tenderness, burning, and itching, is the same in all cases, and may take the form of smearing the skin with a 3 per cent preparation of chloretone (Chlorbutol) dissolved in paraffin, or by applying warm compresses of bicarbonate of soda (1 oz. to the pint), or by the inunction of adrenalin and chloretone ointment (P. D. & Co.). The latter must be used sparingly if applied to extensive skin areas.

Erythema of Drug Origin

A great many drugs when given orally, or applied directly to the skin, produce characteristic erythematous rashes in susceptible children. Chief amongst these are the iodides, bromides, belladonna, antipyrin, arsenic, and camphor. The administration of an enema may occasionally produce a scarlatiniform rash, which though for the most part confined to the buttocks, may extend to other parts of the body. This rash seems to be independent of any medicaments added to the enema : I have seen it follow the injection of plain water. It may be due to the solution and absorption of toxins of fæcal origin.

Treatment. *Prophylactic.* This consists in the avoidance of drugs to which children are hypersensitive or allergic.

Curative. Cessation of administration of the responsible drugs. In the case of bromide rashes, these may at times be cured by doubling the dose or by giving it in combination with arsenic. Drug rashes as a rule cause no irritation or discomfort, and disappear soon after the cause ceases to act. They therefore require no local treatment.

Erythema Multiforme

This is a very troublesome erythematous rash, which has a symmetrical distribution on the limbs and face, as well as sometimes on the mucous surfaces of the cheeks and lips. The rash may take a papular, vesicular, bullous, or nodular form, or any combination of these. It is supposed to be due to the circulation

of a toxin derived from some infective focus. It might with propriety be included among the allergic disorders, for it has been proved, at least in certain cases, to represent an allergic reaction to toxins of bacterial origin, and this probably explains why it has at times been regarded as a manifestation of rheumatism or tuberculosis.

Treatment. *Prophylactic.* Since any septic focus, such as a whitlow, diseased tonsil, carious tooth, or impetiginous lesion, as well as tuberculous or rheumatic conditions may give rise to this affection, such possible sources of trouble must be carefully sought for, and if found, appropriately treated.

Curative. In my experience the treatment of this disease is difficult and unsatisfactory. The children who suffer from it are usually debilitated and weakly subjects, and require careful dieting and tonic treatment. They should be kept in bed and if possible in the open air. Special attention should be paid to the supply of vitamins and mineral elements. The antiseptic treatment of the bowel should be attended to, as large contributions of toxins are often provided from this source. From this point of view I have found both the sour milk treatment (page 695) and the intensive creosote treatment (page 441) extremely useful.

As for local applications, I regard the use of ointment of oleate of thorium (page 702) extremely efficacious. If the rash is widely distributed, the skin should be washed with a medicated soap, such as Evans No. 10, which contains 10 per cent of ichthalmol, a blackish-brown viscous liquid, mainly consisting of ammonium ichthosulphonate, which has antiseptic properties.

Erythema Nodosum

It is quite likely that this disease also represents an allergic reaction to bacterial toxins, the most common forms of which are those derived from the tubercle bacillus, or from the hæmolytic streptococci. It affects the front of the shins in the form of red, tender and painful nodules, which appear in successive crops, each lasting about 14 days. There are also constitutional symptoms.

Treatment. *Prophylactic.* As the attacks are liable to be recurrent, treatment during periods of immunity should be directed to any discoverable primary disorder. In view of the possibility of the disease being secondary to tuberculous or rheumatic affections, evidence of any predisposition to either of these diseases should be sought for, and if found, appropriately treated.

Curative. The child should be kept in bed during the acute phases of the disease, with a cradle to protect the painful and tender limbs. In view of the fact that the majority of children who suffer from this disease give no direct proof that they are suffering from either rheumatism or tuberculosis, I think it a good plan to treat them for whichever of these diseases their symptoms more particularly point, or to which they possess some familial predisposition.

Erythema Induratum Scrofulosum

(Bazin's Disease)

This disease is very similar to the foregoing. Indeed, it may be only a variety of it, but of a somewhat more severe type. It is however definitely associated with tuberculosis, and the skin lesions are now generally regarded as tuberculides.

Treatment. The general treatment is that of the primary disorder. The local treatment should be conducted on the same lines as for erythema nodosum, namely by protection with a cradle.

ERYTHEMAS OF MORE PERSISTENT DURATION

Erythema Circinatum

(Annular Centrifugal Erythema)

This form of erythema is in my experience of more frequent occurrence than one would be led to believe from text-book accounts of the disease. I think it may be because the lesions are so slight that they are not thought to be serious enough to be taken to hospital. They are, however, often seen in Welfare Centres. I have frequently had cases of this kind brought to me under the supposition that the children were suffering from ring-worm, to which disease the erythematous rings bear a very striking resemblance. The eruption consists in the first place of a raised erythematous patch which enlarges concentrically, clearing up in the centre. As these patches grow at the periphery and coalesce with other patches they form annular and polycyclic patches of somewhat weird appearance, like fairy toadstool rings. The rash appears to be of toxic origin, and to be related to erythema multiforme.

Treatment. The treatment is the same as that described for the latter condition, and is exceedingly amenable, if not too large an area of skin is implicated, to painting with iodine liniment.

Granuloma Annulare

(Ringed eruption ; Lichen annularis)

This is a somewhat rare affection which begins as a series of small nodules, rather like boiled sago grains, arranged in the form of a circle or crescent and ranging from ½ inch to 2 inches in diameter. The seats of election are the dorsal sides of the fingers, the wrists, elbows and knees. The cause is probably a toxin of bacterial origin excreted by the sweat glands in the neighbourhood of which the lesions usually occur.

Treatment. *Prophylactic.* Preventive treatment consists in dealing with the sources of the toxin, if such can be discovered.

Curative. The lesions themselves should be painted with collodium containing 2 per cent of salicylate acid. Successful results have been reported from the use of X-rays, but I have no personal experience of this method of treatment.

VESICULAR AND BULLOUS ERUPTIONS

Herpes

Herpes is usually classified in two categories :

(1) *Herpes Simplex*, which is further differentiated into two sub-classes—Herpes facialis, and Herpes progenitalis.

(2) *Herpes Zoster*, which is usually regarded as a separate pathological entity.

For my part, I cannot help thinking that etiologically and pathologically, they are of the same nature, though of different degrees of severity.

(1) Herpes Simplex. This variety of herpetic eruption may occur in any part of the body, but the seats of election are undoubtedly the face, more especially the lips, and also the external genitals. Reference has already been made (page 460) to the special form in which it occurs on the buttocks, and in this situation it constitutes one of the varieties of sore buttocks. While there is good reason to believe that herpes zoster, and according to my own belief, herpes simplex also, is due to a virus which under normal conditions exists on mucous surfaces as a harmless saprophyte, but which under certain conditions assumes pathological attributes, there can be no doubt that peripheral and reflex irritation, as well as a number of different infectious diseases, including the " Common Cold," are also determining causes of an attack. This is of importance in connexion with preventive measures.

Treatment. *Prophylactic.* Since attacks of herpes are recurrent, a consideration of the contributory and determining factors of its causation naturally plays an important part in the prevention. The latter should be sought for, and if found made the subject of prophylactic treatment. Although it is impossible to prove a negative, nevertheless, I cannot help thinking from my own personal experience that a small dose of quinine, say $\frac{1}{4}$ to 1 gr., or a large dose of hexamine, about 4 gr., given at the beginning of an ordinary cold or other infection which from previous knowledge is known to precede an attack of herpes, may prove definitely prophylactic.

Curative. This consists in preventing the papules or the vesicles, as the case may be, from becoming secondarily infected, by pyogenic organisms, that is to say, in preventing them from becoming pustular or ulcerated. This is best done by painting them in their early stages with collodium or Whitehead's Varnish (compound iodoform pigment). In the event of ulceration or suppuration, the lesions should be treated with dilute ammoniated mercury ointment, and great care should be exercised in the case of herpes progenitalis to keep the lesions as clean as possible and free from urinary or fæcal contaminations. Pain is somewhat difficult to control; it should be dealt with in the same manner as described under herpes zoster.

Herpes Zoster

(Shingles: Ignis Sacer)

As already indicated, this skin lesion is usually regarded as a pathological entity and distinct from herpes simplex. Whether this is so or not, it is almost certain that herpes zoster itself is due to a virus, probably related to other virus infections, such as varicella, encephalitis lethargica, and anterior poliomyelitis. A great number of different names have been applied to this disease, according to the part involved. For instance, herpes of the forehead is called herpes zoster frontalis, herpes of the eye herpes zoster ophthalmicus, and herpes of the arm herpes zoster brachialis. It is characterized by the development of vesiculated erythematous papules which are distributed along the terminal course of the involved nerves, while inflammatory and degenerative changes occur also in the corresponding posterior root ganglions. The determining cause of an attack, acting in conjunction with the virus, is usually some shock of physical or psychological character: cold also, as well as a variety of infections, appears to be an etiological factor of importance.

Treatment. *Prophylactic.* On the assumption that the cause of this affection is a virus activated or rendered virulent by other etiological factors in the environment, it is clear that prophylaxis will depend on the prevention of those events which are known to have been associated with previous attacks. As in the case of herpes simplex, I believe that attacks can be aborted in certain instances if in their early stages they are treated with small doses of bromide of quinine, or large doses of hexamine.

Curative. The actual treatment of the rash will depend to some extent on the seat of the eruption. If by any chance it should involve the eye (herpes zoster ophthalmicus) the condition is so serious that the advice of an ophthalmic surgeon should be sought.

General Treatment. This depends on promoting the bodily health of the child, by correct feeding, and attention to the bowels. The pain may be relieved by phenacetin or antipyrin (gr. 1), or cibalgin ($\frac{1}{4}$ tablet), or better still perhaps, by the hypodermic injection of a small dose of morphia, say 1/60th of a grain.

In the early stages before the development of the actual rash, the painful area may be treated with 10 per cent Anæsthesin ointment (Bayer : page 702) ; with a warm water solution of Boro-chloretone dusting powder (Parke Davis & Co. : page 704), or the skin may be rubbed with menthol liniment (page 708). Further, plasters may be applied to the part of the spine giving origin to the affected nerve.

After the eruption has appeared the vesicles should be protected from injury or secondary infection by a coating of collodium, or better, with Whitehead's Varnish (compound iodoform pigment), but if suppuration or ulceration has supervened the raw surfaces should be treated with dilute ammoniated mercury ointment. If an extensive ulcerated area should develop it should be treated like a burn of the 2nd or 3rd degree with fresh solution of tannic acid, or with a saturated solution of picric acid. One of the worst cases of this kind I ever met with was in a child 4 years of age, in which half of the scalp was completely denuded of epithelium by a deep herpetic ulceration, which left an extensive granulating surface like that of a serious burn. This was in the days before tannic acid treatment had been introduced. The whole of the surface was dressed with a saturated solution of picric acid on lint : the pain was greatly relieved, and the granulations rapidly became cleaner. In the later stages they were treated by skin grafting.

After the appearance of the rash, as in the pre-rash period, sleep may be promoted and pain relieved by phenacetin (gr. 1), or cibalgin ($\frac{1}{4}$ tablet), or in extreme cases by hypodermic injections

of 1/60th of a grain of morphia. The application of plasters over the vertebral column at the level of the exit of the involved nerves often gives excellent results, as also does the passage of a galvanic current of 2–3 milliampères, by placing a positive electrode on the spine and drawing the negative electrode along the course of the affected nerves.

Bullous Eruptions

The term " Pemphigus " which means blebs or blisters, has been applied to a great variety of bullous eruptions which are met with in infants and young children. As for instance, the bullous syphilide, which so commonly affect the skin, and especially the palms of the hands and the soles of the feet in congenital Lues (pemphigus syphiliticus): the bullous form of contagious impetigo in young infants (pemphigus neonatorum); the bullous variety of erythema multiforme (pemphigus arcuatum); and the bullous type of urticaria (urticaria bullosa).

In young children, and especially in new-born babies, any localized inflammation of the skin tends to lead to a considerable effusion, and elevation of the corneous layers of the skin in the form of a blister. This is due to the fact that the outer layers of the skin are still soft and easily detached from those lying underneath, owing to their prolonged maceration during intra-uterine life. The above bullous eruptions are therefore widely different in their etiology and in their essential pathogenesis and are not entitled to be classified as belonging to one and the same category. Moreover, they are referred to in other parts of this book under their appropriate headings.

The term " Pemphigus " is now generally reserved for the following conditions—(1) pemphigus acutus, (2) pemphigus chronicus, (3) pemphigus foliaceus, and (4) pemphigus vegetans. But these varieties are rarely found in infants and young children and need but little description.

(1) Pemphigus Acutus. This is a very rare type of an infective form of pemphigus and is almost exclusively confined to adults.

(2) Pemphigus Chronicus. This is the variety of pemphigus which is usually meant when no qualifying adjective is applied to it. It may be recognized by the fact that the blebs appear in successive groups without previous erythema, and in irregular fashion without any group arrangement.

Treatment. *Prophylactic.* Nothing is known of the etiology of this condition, except that it is supposed to be of an infective order, and consequently there is no known means of prevention.

Curative. The local treatment consists in applying a mild antiseptic ointment which should be rubbed all over the affected skin, followed by a bland dusting powder, such as oxide of zinc and talc. The skin should be covered with butter muslin and the limbs lightly bandaged. When seriously ulcerated mercury ointment should be applied.

(3) Pemphigus Foliaceus. This eruption may occur in the youngest child, but there is always some doubt as to whether it may not be a variant of dermatitis herpetiformis.

Treatment. *Prophylactic.* Nothing is known of the prophylaxis of this complaint, but it is probably due to some form of infection. Possible sources of infection, such as unhealthy tonsils, intestines, or teeth, should be searched for, and if found, treated.

Curative. The curative treatment of this condition must be taken seriously. The patient must be confined to bed, and for preference placed on a water-bed, as the skin is exceptionally vulnerable. The patient should have frequent antiseptic baths, consisting of a weak solution of potassium permanganate. After the bath, a protective cream or paste, such as one of calamine or zinc oxide should be smeared over the affected surfaces.

(4) Pemphigus Vegetans. This is a very rare skin affection, and is mainly found in infants and young children. It is characterized by cauliflower-like vegetations situated chiefly in the axillæ and perineum, arising from the floors of affected vesicles or bullæ.

Treatment. Both the prophylactic and curative treatment is the same as that recommended for chronic pemphigus, excepting in so far that the vegetations should be cleaned up by means of hydrogen peroxide or other suitable antiseptic. When the vegetative surfaces are extensive antiseptic baths should be given.

SKIN DISEASES OF PARASITIC ORIGIN

(Animal, Fungous, and Microbic)

ERUPTIONS DUE TO ANIMAL PARASITES

Scabies

(Itch)

This disease is due to a small animal parasite—the Acarus Scabei, the female of which burrows in the skin and there lays her eggs. The burrows are mostly found between the fingers and on the sides of the hands, on the wrists, and in male children

on the prepuce. If carefully looked for with a lens, the burrows can usually be identified and the female Acarus demonstrated and picked out with a needle-point. The irritation and scratching to which this burrowing gives rise often leads to secondary urticaria, eczema, and impetigo, which complicates both the diagnosis and prognosis.

Treatment. *Prophylactic.* The disease is highly infectious and often occurs in epidemic form in institutions. For this reason, all infected persons must be energetically treated, and watch kept upon children who come in contact with them for the first evidence of the disease. After a cure has been effected clothing should be sent to the Public Disinfecting Station to be baked.

Curative. This consists in lathering the whole of the body very thoroughly with soft soap. The most commonly affected parts, such as the hands, wrists, axillæ, umbilicus, and penis, should be well scrubbed with a soft nail-brush. The child is then immersed up to the neck in a hot bath, where he is allowed to remain for about 20 minutes. After thorough drying with a rough turkish towel, sulphur ointment, consisting of 1 drachm of milk of sulphur to the ounce of soft paraffin, is well rubbed into the skin. This treatment is repeated the next day, and again 3 days later. During this time the child should wear the same clothes, as they become saturated with the ointment and expedite the cure. This method of treatment is simpler and on the whole more efficacious than the more complicated one of giving sulphur baths.

Complications. Complications such as eczema, urticaria, impetigo, or superficial ulceration, sometimes make it impossible to apply the specific sulphur treatment until the inflammatory condition of the skin has been cured by the application of calamine or some other soothing preparation.

Harvest Bug

(Leptus autumnalis)

This is another instance of a skin disease produced by the burrowing of an Acarus. It is common in August and September in England.

Treatment. *Prophylactic.* Dusting of the skin with sulphur powder is a fairly reliable preventive in those who are subject to attacks of this parasite in parts of the country where it is indigenous.

Curative. Treatment consists in soothing the irritation by rubbing the affected parts with Dettol, diluted with an equal part of water.

Pediculosis Capitis

(Head Louse)

Pediculosis capitis is due to the presence of the above louse in the head. The scalp is usually inflamed, excoriated and encrusted with the dried exudate from impetiginous sores. The occipital and other glands connected with the lymphatic system of the scalp are often enlarged and inflamed. In old-standing cases the distal part of the hair shafts may be studded with empty nits, while the ova more recently laid are found at the proximal ends of the hair near the skin. By the distance of the nits from the roots of the hairs the duration of any case of pediculosis capitis may be fairly accurately gauged.

Treatment. *Prophylactic.* Infection very easily spreads from child to child by direct contact, by sleeping in the same bed, by the use of a common hair-brush or towels, or the exchange of caps or hats. Infected cases should be energetically treated and if possible isolated until a cure is effected.

Curative. The curative treatment consists in—

1. The killing of the pediculi.
2. Getting rid of the nits.

Fully developed pediculi are very easily killed if they come in contact with dilute ammoniated mercury ointment. A small quantity of this rubbed into the roots of the hair and the subsequent wearing of a washable cotton cap will soon get rid of the living parasites.

The removal of the nits is not so simple a matter. These are very firmly attached to the shafts of the hair by means of a chitinous cement which is very resistant to solvents. Many applications are credited with the power of loosening these nits from their anchorage, as for instance, petrol, benzine, zylol, and acetic acid, but in my experience none of them can be relied on to effect the desired object. When I was Medical Inspector of Schools under the London County Council, I devised a method of removing nits which was very effective in the schools over which I had charge. It consisted in lathering the head very thoroughly with a solution of soft soap to which one third part of crude paraffin had been added. The lather was removed from the hair with a fine-tooth comb, and in this lather were entangled the nits, which could easily slide along the length of the hair, although they could only with great difficulty be picked off in any other way. The procedure was as follows :

The first night dilute ammoniated mercury ointment was well

rubbed into the roots of the hairs, and the scalp subsequently covered with a washable cotton cap. The next night the head was treated with soft soap and combed in the manner above described. One week later the operation was repeated to kill any living parasites which had escaped the first treatment, or which had subsequently hatched out of any remaining nits. In nearly every case this simple method was completely successful. The persistence of a few empty nitshells at the free ends of the hair, distal from the roots, does not imply the failure of the treatment.

Complications. The hair may become matted together by crusts formed by the exudate of septic sores. In these crusts numerous pediculi and their eggs may be embedded. For this condition, an ointment consisting of equal parts of zylol and soft paraffin may be applied, and the head protected by means of a washable cotton cap. This ointment should be left on the scalp for 24 hours, and after that it may be washed off with soft soap and a simple ointment consisting of 2 per cent Lysol applied. If these measures are carried out, it is seldom necessary to shave the head or cut the hair.

Pediculosis Corporis (Body Louse); Pediculosis Palpebrarum; Pediculosis Pubis (Crabs)

All these varieties of louse are so rare in children that their treatment need not be described here.

Skin Eruptions due to Fleas, Bugs, Gnats, Mosquitoes, Caterpillars, etc.

A great many different skin eruptions may be due to the bites of these various insects, or to the irritation caused by hairs of caterpillars. In severe cases an irritative eczema or dermatitis may result, especially in allergic subjects.

Treatment. *Prophylactic.* Apart from the avoidance of the exciting causes of these skin lesions, little can be done in the way of prophylaxis, but pyrethrum seems to exercise a deterrent action on fleas, and a small bag of this powder pinned to the underclothing acts as a useful preventive. Guaiacol powder has a somewhat similar action on bugs. It may be scattered sparsely between the sheets. Apart from this, the sealing up of cracks in the walls of vermin-infested rooms, and the spraying of naphthalene also seem to have some prophylactic value.

Curative. In the majority of cases no treatment is required further than to relieve the irritation which is caused by the bites.

For this, the application of Dettol, either undiluted or diluted with an equal part of water, and well rubbed into the skin is a very effective means of treatment.

In the case of mosquito or gnat bites which have developed into pustules or small abscesses, these are best treated by carbolic acid fomentations, and the evacuation of the pus.

SKIN ERUPTIONS DUE TO FUNGI

Ring-worm

Ring-worm can affect almost any part of the body, including the scalp, the glabrous skin, and the nails. The fungi or dermatophytes which are responsible for the trouble exist in great variety, but their exact classification has not yet been determined. They are however mould-fungi, which flourish in the skin in the form of a dense mycelial growth which breaks up into small sections to which the term "spores" has been incorrectly applied. Although formerly the members of the ring-worm family were classified as "large-spored" (megalospora), or small spored (microspora) according to the size of these segments, this terminology has now been abandoned in favour of one which recognizes the existence of two groups:

(*a*) The Microspora,
(*b*) The Trichophyta,

both of which can be further divided into a very large number of sub-classes.

At a low estimation 90 per cent of cases of ordinary ring-worm of the scalp, in Britain at least, are due to Microsporon Audouini, although occasionally the disease is caused by one or other of ten independent varieties, which are derived from different animals, such as the horse, cat, or dog, etc. The Trichophyta are mainly of animal origin, but they also affect human beings, chiefly adults, and some of them give rise to very severe inflammatory and suppurative reactions of the scalp.

Tinea Tonsurans.

Tinea Tonsurans, or ordinary ring-worm of the scalp (Tinea Capitis), the common variety met with among children, is due, as has already been indicated, to the presence of either Microspora or Trichophyta organisms, but generally the Microsporon Audouini, and although mainly spread from human sources may owe its origin to various affected animals.

Treatment. *Prophylactic.* All attempts at producing im-

munity by inoculation have so far proved disappointing. A certain amount of immunity appears to be imparted by one attack —a second attack is exceedingly rare, and therefore one may hope for more satisfactory results from artificial immunization in the near future. At the present time, however, the only practical means of prevention appears to lie in the isolation of already existing cases, and the exercise of the greatest care in avoiding the spread of infection.

Curative. Ring-worm of the scalp cannot be cured by the application of local fungicides, be they never so potent. The only way to get rid of the trouble, is a complete epilation of the whole scalp, and the subsequent treatment of the denuded area on the same lines as are applicable in cases of ring-worm of the glabrous skin. The easiest and most practical method of epilation is by X-rays, which may be carried out as follows :

In order to treat the whole scalp, which in the great majority of cases is essential, the latter is divided into five areas, namely, the frontal, crown, occiput, and two parietal areas over the temporal bones, the central points of which are about 5 inches apart. To each of these areas the cathodes of the tube must be applied at a distance of 15 cm. from the skin. Four-fifths of a pastille dose is applied to each of the marked points. The hair begins to fall out about the 15th day from the time of treatment, and epilation is complete in a week from this date. New hair begins to grow after 5 or 6 weeks. After this operation no treatment is necessary except to wash the head occasionally with a solution of 1 in 40 Monsol to prevent the spread of infection due to falling hair. During this period of cure the child should wear a washable cap. After epilation is complete the whole of the scalp should be treated occasionally with a 10 per cent Monsol ointment. The only danger of this method is permanent baldness, which however may be prevented by careful adherence to the points of application of the cathodes, and the measured doses as described above. The treatment of Tinea Capitis by means of acetate of thallium taken by the mouth is dangerous and consequently is not recommended, while treatment by the artificial Kerion method is troublesome and not satisfactory.

Tinea Circinata.

This form of ring-worm affects the glabrous skin and is often of animal origin, and of the trichophytic type.

Treatment. *Prophylactic.* This is the same as that for Tinea Tonsurans (page 475).

Curative. This is simple and only requires the repeated appli-

cation of double-strength iodine ointment, or 10 per cent solution of nitrate of silver. The applications should be repeated three or four times at intervals of 2 days.

Tinea Unguium : (Ring-worm of the Nails ; Onycho-mycosis tricophytica).

Ring-worm of the nails is somewhat difficult to treat successfully without actual evulsion of the nail, which should be done under a local anæsthetic. After the nail has been removed, the raw surface should be treated with Whitefield's Ointment (see page 702).

Tinea Versicolor (Pityriasis Versicolor : Liver Spots).

This affection of the skin is due to the growth of a fungus, the Microsporon Furfur, which gives rise to a fine desquamating rash of a colour which varies from pale fawn to fairly deep brown. The patches look like areas of dirty skin. Small patches eventually coalesce to form larger ones of irregular outline. The main distribution is on the chest, but it may occur on the neck and elsewhere. Scrapings soaked in liquor potassæ and examined under the microscope reveal a characteristic mycelial growth with spores or perhaps more correctly speaking broken up segments.

Treatment. *Prophylactic.* This consists in the thorough and routine cleaning of the skin with careful drying, especially the folds of the skin or hairy parts. The wearing of flannel underclothing, especially in the case of those who are inclined to excessive sweating, always seems to me to be a predisposing cause. For this reason cellular underclothing is indicated : tuberculous subjects are particularly liable to be affected.

Curative. After a thorough scrubbing with a nail-brush and soft soap, the whole of the affected area should be painted with liniment of iodine. This procedure should be repeated every 3rd day for 2 or 3 weeks, or oftener, if necessary. The severity of the treatment however must be tempered to the degree of sensitivity of the skin. In the case of hypersensitive skins this line of treatment may have to be abandoned for sponging with a 1 in 8 solution of hypo-sulphite of soda.

Favus (Tinea favosa ; Porrigo sculula ; Porrigo lupinosa).

This is a contagious mycotic disease due to the growth of a fungus of the genus Achorion (Achorion Schœnleinii), mainly on the scalp, but occasionally on glabrous skin and nails. It gives rise to yellowish, cup-shaped, and friable crusts, not unlike the rind of a matured Stilton cheese, and accompanied by a mouse-like odour. It is usually transmitted from child to child, but occasionally from domestic animals. It is a rare disease in

England, though fairly common in Eastern Europe and occasionally met with in parts of Scotland.

Treatment. *Prophylactic.* The avoidance of infected persons and animals.

Curative. This disease, which closely resembles ring-worm as to pathology and origin, yields to exactly the same kind of treatment, namely, to exposure to X-rays. The details of the treatment are the same as those given for ring-worm (page 475).

Complications. Pediculi Capitis are quite commonly present in cases of favus, and must be efficiently treated (page 472) before attempting to deal with the favus itself. The same statement applies to the impetiginous patches which often accompany favus.

Actinomycosis.

This disease of the skin is comparatively rare in infants and young children, but when it does occur a correct diagnosis is satisfactory from all points of view. It is due to the development in the body of the Ray fungus, which occurs in cattle and horses and can be transmitted from them to human beings, either directly or through the medium of straw or hay. The fungus usually reaches the skin from an underlying focus of diseased bone. The commonest areas to be affected are the angle of the jaw and the back of the neck over the vertebræ. The lesions generally take the form of a hard dusky-red swelling, not altogether unlike a small superficial sarcoma. The swelling gradually breaks down in the centre, and points in several places, forming fistulous openings, through which exudes a yellow sero-purulent or sanguineous discharge, containing a number of minute granules about the size of a pin's head, which are yellowish-grey or sulphur coloured. These granules, which are pathognomonic of the disease, contain small masses of the fungus, which may be demonstrated under the microscope if the discharge is treated with liquor potassæ.

Treatment. *Prophylactic.* This disease is sometimes caused by a prick from a spicule of contaminated cereal, or from chewing a straw, or from picking the teeth with some infected object, and consequently is more liable to occur among those who live in the country, or on farms, or who are associated in some way with horses or cattle. Prophylaxis necessarily involves the avoidance of such risks as may be associated with these sources of danger.

Curative. This consists in the internal administration of iodide of potassium in large doses. For a child 5 years of age, 15 gr. three times a day is not too large a dose, though smaller doses

may be given at more frequent intervals. The iodides appear to have almost a specific action. They may be given subcutaneously by the hypodermic injection of Entodon (Bayer) ½ c.c. every second day.

Vaccine treatment has been tried with some little success. One million mycelial fragments, or 1 mm. of the vaccine (Parke Davis & Co.) should be injected weekly for 6 consecutive weeks, and secondary infections, either staphylococcic or streptococcic, which are exceedingly common and serious, should be treated simultaneously by appropriate means.

Local treatment consists in opening up the abscesses, and in thorough curetting and swabbing of their interior with Monsol (1 in 20), or iodized carbolic acid. Subsequently X-ray treatment promotes healing and relieves pain. If the lesion is an extension from, or connected with a diseased bone or tooth, these foci of danger must be appropriately treated.

DISEASES OF THE SKIN DUE TO MICROBIC INFECTION

Staphylococci

There are three common forms of Staphylococci which give rise to skin lesions :

1. Staphylococcus cutis-communis (Sabouraud's Staphylococcus : The Grey Coccus).
2. Staphylococcus pyogenes albus.
3. Staphylococcus pyogenes aureous.

All these varieties of staphylococci appear to be normal saprophytic inhabitants of the skin, especially in moist and warm situations, but owing to various, and at present unknown, causes, they sometimes acquire an enhanced degree of virulence and become pathogenic. The skin lesions to which these organisms give rise may take various forms, for instance, that of desquamation, vesiculation, pustulation, furunculosis, whitlows, impetigo (Bockhart's), and wart-like growths. In infants and young children however the common skin lesions due to staphylococcic infections are multiple cutaneous and sub-cutaneous abscesses, impetigo, scurf, seborrhœic dermatitis, and seborrhœic eczema, although involvement of the sebaceous glands by these same organisms gives rise to a variety of other skin affections, such as acne vulgaris, comedones, etc., which will be described under their appropriate headings. The only staphylococcic infections

of the skin which will be described here are Bockhart's impetigo : multiple abscesses : furunculosis : and pityriasis of the scalp (scurf).

Impetigo of Bockhart

(Superficial pustular perifolliculitis)

This disease consists in the development of multiple pustules of small size at the orifices of the pilo-sebaceous follicles. This form of impetigo is distinguishable from the more common and ordinary form of impetigo, namely, that of Tilbury Fox, by the fact that the pustular stage is not preceded by any preliminary vesication, and hence the term " Pustules ab initio " has been applied to the lesions of Bockhart's impetigo. The pustules develop for the most part on the extensor aspects of the limbs and on the scalp of infants. They commonly dry up in a few days to form crusts, desquamation following, and then the attack is at an end. But unfortunately, it is apt to be followed by recurrences, which may continue for many months. The affection is due to the *S. pyogenes albus* and *aureous* which are generally derived from some contiguous septic focus, such as an abscess, ulcer, or sinus.

Treatment. *Prophylactic.* This consists in the careful management of existing foci of suppuration by antiseptic treatment and prompt removal of discharges, and in the protection of neighbouring parts. Raising the resistance of the child against infection by good hygienic conditions and vitamin therapy, also forms part of the prophylactic treatment, which may include the immunization of the child by specific vaccine treatment.

Curative. The cure of the disease when confined to the glabrous areas is comparatively easy, and consists in the preliminary removal of crusts by boracic acid fomentation and subsequent inunctions of a 2 per cent ammoniated mercury ointment. When however the disease affects the scalp, treatment becomes much more complicated. The hair should be cut short and the crusts removed by poulticing. Any suppurating points should be painted with a solution of tincture of iodine 4 parts in 60 of spirit. This painting treatment should be repeated two or three times a day for as long as may be necessary, or until the oozing has ceased. After that stage is reached the whole of the scalp should be smeared with a 2 per cent ammoniated mercury ointment, and the head bandaged.

Furunculosis

(Boils)

Individual boils, as well as groups and successions of boils, are common incidents in infancy and childhood, but not perhaps quite as common as in early adult life. The boils are due to the development of both *S. pyogenes albus* and *aureous*, and are predisposed to by damp conditions of the skin, all forms of irritation, and by lowered vitality and reduced resistance.

Treatment.

Prophylactic. Prevention consists in the treatment of any existing disturbance of health, and in the avoidance of local irritation, and also in the observance of all those hygienic measures which are calculated to raise resistance to microbic infection.

Curative. Apart from attention to the general bodily health by following the usual principles of hygiene, there are four remedies, which if they do not possess actual specific properties, at least have a favourable influence on the course of the disease. These are :

(1) Sulphur.
(2) Collosol manganese.
(3) Yeast preparations.
(4) Vaccine treatment.

In intractable cases all these remedies should be combined or tried in succession.

(1) Sulphur. Sulphur exercises its curative action partly by serving as an intestinal antiseptic and partly owing to its excretion by the skin, and its local germicidal influence. It is best administered to children in the form of the confection, and should be given three times daily to the extent of $\frac{1}{4}$ of a drachm. This amount should not cause any looseness of the bowels, but if it does so, the sulphur may be given in the form of Crooke's Collosol preparation : 20 drops of this in 1 tablespoonful of water may be given three times a day by the mouth. Sulphide of calcium, a very popular remedy in the case of adults, is not altogether satisfactory for young children, as the necessarily small dose does not contain enough sulphur to exercise any beneficial influence on the course of the complaint.

(2) Manganese. Manganese in its Collosol form (Crooke's), and injected intra-muscularly to the extent of 0·5 c.c. at intervals of 3 days, often gives good results. This preparation is supplied in ampoules containing this amount.

(3) Yeast. This may be given in various forms. Personally, I have found it most convenient to administer it as Yestamin tablets (page 708), 15 grains daily, and crushed up and suspended in milk or honey. I do not recommend the giving of fresh brewer's yeast, as it is inclined to cause fermentation in the bowel and flatulence.

(4) Specific Vaccine Treatment. The vaccine treatment of furunculosis is one of the most satisfactory of all specific methods of this kind. It is best carried out by the use of a mixed autogenous and stock vaccine. The first dose should consist of 50 million organisms, followed 4 days later by double this number. Owing to the difficulties attaching to the preparation of an autogenous vaccine, it is generally found necessary to fall back on a simple stock vaccine, such as that supplied by Parke Davis & Co. (Staphylococcus vaccine mixed), which gives quite satisfactory results.

Local Treatment (Abortive Method). In the early stages of the development of boils further progress may be prevented by the injection of one drop of pure carbolic acid into the centre of the furuncles by means of a fine hypodermic needle. Exposure to ultra-violet rays or mercury vapour lamp has also been claimed to have an abortive influence. A boil however may be hurried through its successive stages of congestion, suppuration, and pointing by boracic fomentation, if the lesion is situated in a suitable position for such treatment. Each time the fomentation is changed the surrounding skin should be swabbed with a solution of perchloride of mercury (1 in 4000) to prevent extension of the infection to neighbouring parts. When the boil is quite ripe, but not before, it should be incised, with a fine tenotome or bistoury, but it should not be squeezed. Boils in the case of children very rarely have regular cores, and this explains why carbuncles occur so seldom at this age.

Multiple Cutaneous and Subcutaneous Abscesses

In my experience, recurrent abscesses of the above kind are not at all uncommon in infants of low resistance. They are due to the *S. pyogenes aureous* and *albus*. The abscesses are as a rule remarkably rapid in reaching the pointing stage, and consequently are easily distinguished by this characteristic from tuberculous abscesses and scrofulous gummata, to both of which they bear certain superficial resemblance.

Treatment. *Prophylactic.* Since it is not known whether infection is effected through the blood-stream or by surface spread, rational preventive measures are somewhat speculative, but they

appear to depend to some degree on the successful building up of the resisting powers of the child by good feeding and intensive vitamin therapy, in the antiseptic treatment of the skin itself, and in the avoidance of the spread of infection from discharging abscesses by means of clothing, or other objects.

Curative. The abscesses themselves must be treated on ordinary surgical lines by opening when ripe and by evacuating their purulent contents. Otherwise the condition must be treated in accordance with the directions given under furunculosis (page 480).

Pityriasis

Although there is considerable confusion with regard to the classification of the various skin lesions which pass under the name of pityriasis, the condition may be defined as localized desquamation of fine scales due to the presence of, or at least associated with the presence of two organisms, which can be discovered by the microscopical examination of the scales—they are :

1. The *micrococcus cutis communis* of Sabouraud, or the Grey coccus.
2. The *bottle bacillus* of Malassez (Flask Bacillus of Unna).

The disease can attack either the glabrous skin or the scalp, and when it attacks the latter it gives rise to the common condition known as scurf or dandruff.

Pityriasis of the Scalp (Scurf or Dandruff).

This very common affection in children requires no detailed description. It seldom occurs in a sufficiently pronounced form to be recognized before the age of 5 years, but it certainly occurs in a mild degree long before this period, and the only outward evidence of its existence may be a slight reddening of the scalp which develops after a bath or when the head has been washed. The condition is characterized by the exfoliation of dry powdery scales, mainly on the crown of the head, and only very slightly so on the parietal or occipital regions. If neglected, the affection is liable to develop into a regular seborrhœa capitis, or seborrhœic eczema, and finally to lead to an early falling out of the hair and premature baldness.

Treatment. *Prophylactic.* This consists in recognizing the condition in its early stages when there is only a little redness and irritation of the scalp after bathing. It is usually stated that the affection is easily cured by frequent washing with soap and water, but with due respect to my dermatological colleagues

I beg to differ from this view. I believe that frequent washing with soap and water has more to do with its etiology than its cure.

Curative. I always insist on the first evidence of its appearance that the head should not be touched with water, or more particularly with soap and water, and that it should be kept clean by sponging with liquid petroleum containing thymol 1 in 80. Pityriasis of the scalp is certainly associated with, if not caused by, a bacillary infection, and therefore it should be treated antiseptically, and in my experience there is no more useful antiseptic available for this purpose than thymol dissolved in petroleum.

Pityriasis of the Glabrous Skin (Pityriasis Circinata; Flannel Rash)

This skin affection is almost certainly of the same nature as the above (pityriasis of the scalp), and due to the same organisms. It may attack any part of the body, the head, trunk, or limbs. When situated on the forehead at the edge of the hair it sometimes assumes a festooned pattern known as "Corona seborrhœica." If the distribution is confined to the medio-thoracic region it is commonly known as "Flannel Rash."

Treatment. *Prophylactic.* It must be remembered that this disease is contagious, and auto-inoculable, and that antiseptic measures must be adopted to prevent its spread to uninfected persons or unaffected areas. The infection is conveyed by direct carriage, or indirectly by clothing and other objects.

Curative. The treatment for this condition is the same as that for pityriasis of the scalp, only incomparably easier, namely, by repeated application of liquid petroleum in which thymol to the extent of 1 in 80 has been dissolved. In very intractable cases, especially if lichenification has supervened, a pastille dose of X-rays is extremely useful.

DISEASES OF THE SKIN DUE TO STREPTOCOCCI

A great many different forms of skin lesion are ascribed to streptococcal infections: the specific organisms of which appear almost identical, though capable of differentiation by means of their reactions to carbohydrate media. Such common varieties are:

1. Streptococcus pyogenes (Streptococcus erysipelatis).
2. Streptococcus fæcalis.
3. Streptococcus anginosus.

The first-mentioned variety is however the common one, and responsible for the great majority of streptococcal skin infections. The lesions produced differ according as the infection is confined to the epidermis itself, or involves subcutaneous tissues. In the former case the lesion is of an impetiginous character, while in the latter case it may take the form of erysipelas, whitlows, or cellulitis.

In the following account of the treatment of streptococcal infections of the skin, only the more common forms, namely, impetigo contagiosa, and erysipelas, will be described in detail. For the rarer conditions, such as exfoliative dermatitis of infancy (pityriasis rubra), perlèche, or impetigo of the lips, elephantiasis nostras, or localized streptococcal elephantiasis, the reader is referred to some recognized text-book of dermatology. The treatment of the surgical conditions of cellulitis and whitlows, which are also streptococcic infections, hardly comes within the provinces of this book ; further, it must be remembered that a great many other skin lesions primarily of staphylococcal origin, are apt to become secondarily infected with streptococci.

Impetigo Contagiosa

(Contagious Impetigo of Tilbury Fox ; Impetigo Vulgaris)

This is an inflammatory affection of the skin due to the presence of a virulent form of streptococcus, generally the streptococcus pyogenes, which gives rise to superficial vesicles, which in their turn rupture and form crusts of coagulated serum. The inoculation generally takes place through minute abrasions in the horny layer of the skin, the infective matter being conveyed from area to area or person to person by contaminated towels, furniture, toys, etc., and also by scratching to allay irritation of simple forms of dermatitis.

Impetigo takes a bullous form in new-born babies (pemphigus neonatorum) owing to the ease with which the horny layer becomes elevated in consequence of its macerated condition, and an ulcerated form on intertriginous areas where the contiguous surfaces are exposed to friction and dampness, such as those behind the ears, in the groins and in the thigh folds in fat babies.

Treatment.

Prophylactic. Owing to the fact that impetigo frequently complicates other skin lesions, such as urticaria, eczema, scabies, and pediculosis capitis, preventive means must take into account such possible eventualities, and include measures to deal with these primary troubles, and if necessary the application of antiseptic

precautions to prevent simple lesions from becoming secondarily infected with streptococcal organisms. Further, it must be remembered that intertriginous folds such as those behind the ears, and in fat infants the groins and creases at the wrists or in the thighs, if allowed to remain moist, may become macerated and the seat of simple dermatitis which in turn may be secondarily infected with impetiginous organisms. A dermatitis is apt to develop at the corners of the mouth, and at the orifices of the external nares, owing to dribbling of saliva, or the presence of irritating discharges, and these parts may become secondarily infected. In debilitated states, after measles and chicken-pox, with loss of resistance to infections, streptococcal organisms are extremely apt to obtain a foothold and produce impetigo.

Curative. The treatment of impetigo should be directed to:

(1) The General Health.
(2) Vaccine Treatment.
(3) Local Treatment.

(1) General Health. This consists in raising resistance by good feeding, tonics, and intensive vitamin therapy, especially in the case of debilitated and unhealthy children convalescent from infective fevers.

(2) Vaccine Treatment. This consists in the hypodermic injection of mixed streptococcic vaccine (Parke Davis & Co.); 250,000 organisms should be given as an initial dose. If this does not produce a reaction a double dose should be administered in 24 hours. If reaction occurs, increasing doses may be given at intervals of 6 days.

(3) Local Treatment. The crusts or scabs should be removed, and an antiseptic ointment applied. The scabs may be removed by boracic fomentations frequently repeated, at least three or four times in the 24 hours, followed by an application of a 2 per cent ammoniated mercury ointment. Owing to its poisonous properties this ointment must be applied with caution to the corners of the mouth, where it may be licked, or to large surfaces where it may be absorbed. Under such conditions a 5–10 per cent monsol ointment is a good substitute.

Impetigo occurring on intertriginous and moist areas must be kept as dry as possible by preliminary painting with tincture of iodine before it is touched with any form of ointment. In these cases I have found Antipeol ointment which contains certain pyogenic anti-toxins extremely useful (page 701), as soon as the surface has become dry by the antecedent iodine treatment.

Erysipelas

(St. Anthony's Fire)

This is an infection of the skin and subcutaneous tissues with the streptococcus erysipelatis of Fehleisen, which is now generally recognized as being identical with the streptococcus pyogenes. Before the development of a typical attack with constitutional and local symptoms, the virulence of the specific organism appears to be raised by conditions at present unknown, or the resisting powers of the infected person lowered by ill-health, neglect, deprivation, or other debilitating circumstances. It is intensely infectious, and contagious, and conveyed through the medium of infected hands, dressings, clothing, and other contaminated objects. The streptococci are inoculated through some small and often unsuspected abrasion of the skin. One fatal case I met with was caused in a mortuary attendant through the pricking of his finger by a holly leaf, and another one was infected through a pin-prick abrasion and a letter written by a person suffering from the disease.

In addition to the ordinary classical form of erysipelas, there is a mild and recurrent form which is common among children.

Treatment.

Prophylactic. This involves the isolation of all infected persons and the exercise of the greatest vigilance in sterilizing or burning all objects likely to be contaminated. Special care should be taken to observe these precautions in surgical wards and lying-in institutions. Should exposure to a known source of infection occur in the case of a child recently operated on, the use of streptococcus serum as a prophylactic measure is indicated on rational lines, or better still, convalescent serum, if such can be obtained. Ordinary blood transfusions have also some value.

Curative.

General Treatment. The child should be isolated and kept under the best possible hygienic conditions as regards feeding, nursing, open-air treatment, and helio-therapy. Various tonics such as iron, strychnine, and quinine, are generally advised, but personally, I have little confidence in such drug treatment, although a dose of phenacetin (gr. 1) combined with caffeine (gr. ½) may make the child feel more comfortable under conditions of high fever.

Specific Treatment. This consists in the hypodermic injection of 10 c.c. of streptococcus anti-toxin (Parke Davis & Co.) refined and concentrated, and repeated in 24 hours. To be

effective this specific treatment must be given within 72 hours of the onset of the disease. Should the child have had a previous attack, or be suffering from the recurrent form, the precaution of de-sensitization must be taken by giving repeated small doses before venturing on the full dose. The intra-muscular injection of Prontosil (Bayer) (see page 699) raises resistance to infection, and should be given at intervals of 8 hours during the acute stages. The dose should not be more than 1 c.c.

Local Treatment. The best local treatment is by irradiation with ultra-violet light. This should be given to the surrounding area of healthy skin as well as to the affected parts. The rationale of the treatment is to produce a mild condition of erythema and leucocytosis with the object of cutting off the organisms by a phagocytic barrier of white cells in the zone of inflammation. The same object in minor degree is secured by painting the advancing edge with strong tincture of iodine. With erysipelas of the face a lint mask should be worn, and on this may be spread a coating of 30 per cent ichthyol ointment. In such cases, before ultra-violet light treatment is commenced, the eyes must be very well protected by suitable covering.

TUBERCULOUS AFFECTIONS OF THE SKIN

(*Tuberculosis cutis*)

The reactions of the skin to the tubercle bacillus or to its toxin, are protean in character and almost as numerous as those due to syphilis. The character of the lesions differs according to the virulence of the infection, the dosage of toxin, the number of bacilli taking part in the process, the situation of the lesion, and the resisting power of the child. The diagnosis depends on the demonstration of the bacillus, either *in situ* or in some definite focus ; on the appearance of the lesions ; on their clinical course, and on their reaction to tuberculin inoculation. The common forms are lupus vulgaris, scrofulodermia, miliary tuberculosis, erythema induratum (Bazin's disease), tuberculous ulcers, and tuberculous warts, in all of which the tubercle bacillus can be demonstrated. Another group of skin lesions of tuberculous origin, which are not now regarded as being due to the direct action of the tubercle bacillus *in situ*, but to toxins generated at a distance, include tuberculides, lichen-scrofulosorum and acne scrofulosorum. There are other varieties of skin lesions, commonly regarded as tuberculides, such as lupus erythematosus and pityriasis rubra, which may or may not be of genuine tuber-

culous origin. Only those varieties however which are definitely known to be due to reactions to the tubercle bacillus or to its toxin will be described here.

Lupus Vulgaris

This is by no means a common complaint of childhood; if it develops at all it tends to take on a multiple form, irregularly distributed on the face, body and limbs. It usually follows an attack of measles, scarlet fever or chicken-pox. To these cases the term " Lupus post-exanthematicus " has been applied. The diagnosis as a rule presents no great difficulty, especially if the " apple-jelly " nodules can be demonstrated by a cover-slip being pressed firmly over the lesions, and viewed through the glass.

Treatment.

Prophylactic. The prophylaxis of lupus rests mainly on the prevention of the general infection, by paying regard to considerations of heredity, contact with tuberculous patients, and the raising of resistance by good feeding, ordinary hygienic measures and preventive inoculation.

Curative.

General Treatment. This depends on the application of natural heliotherapeutic measures, fresh air, healthy occupation, out-of-door life, vitamin therapy, and the administration of tonics such as iron and the hypo-phosphites and the iodides, especially in the form of the syrup of iodide of iron. All these general measures promote the chances of the child being able to respond satisfactorily to local treatment, which is possibly of greater importance.

Specific Tuberculin Treatment. This is definitely useful, but should be cautiously employed. Various methods have been recommended by different authorities, and different varieties of tuberculin have been employed. My own personal experiences have for the most part been confined to the use of Koch's Old Tuberculin, which I have found very reliable. This should be employed in the same doses as are described for the artificial immunization of infants (page 158), the initial dose should be very small, probably not more than 1/8,000th mg., followed by successive weekly inoculations in which the dose is doubled on each occasion, until it reaches 1/50th mg. when the weekly increments should be made at a slower rate.

Local Treatment. This consists in the surgical procedures of extirpation, curetting, scarification, cauterization, or in the medical procedures of ionization, cupping, high-frequency, or the

application of pyrogallic acid, salicylic acid, arsenic, or other escharotics.

Of all local measures apart from extirpation, that of treatment by the Finsen light method is probably the best and least disfiguring. It is however necessarily prolonged, and consequently expensive, but since such treatment must be left to experts it is unnecessary to give details here.

X-ray treatment is not infrequently employed in these cases as a preliminary to the Finsen light treatment. Radium treatment is also used, but is most expensive. The method of natural heliotherapy is one that is most often employed at the present time, and probably in the end gives the best results. Actually the choice of method to be employed is a matter for experts.

Scrofuloderma

This is a term applied to a number of different kinds of tuberculous lesion of the skin which owe their origin to the spread of the tuberculous process from underlying foci of suppuration, such as broken-down lymphatic glands in the neck, tuberculous bones, joints, etc. Probably the most common site is in the neck, just over the area of a broken-down gland. The skin often becomes the seat of papillomatous vegetations and warty excrescences or even keloids, if the ulcerated surfaces heal up.

Treatment. Both as regards prophylaxis and cure the treatment *mutatis mutandis* is the same as that for lupus vulgaris (page 488).

Miliary Tuberculosis

This is a very rare skin disease in infancy and early childhood, and consists in the deposition in the skin of miliary tubercles about the size of a millet seed. These undergo cheesy degeneration and ulceration, leaving small oval and punched-out excavations with flabby edges. They are generally painless.

Treatment. Both prophylactic and curative treatment are the same as in the case of lupus.

The ulcerations themselves may be curetted and swabbed with iodized carbolic acid.

Tuberculous Ulcers

These ulcers are characterized by secondary infection of a pyogenic nature, superimposed on the tuberculous process.

Treatment. This consists in building up the resisting powers of the child and treating both the secondary and primary infections on the specific lines indicated in their appropriate sections.

Erythema Induratum (Bazin's Disease).

This has already been described on page 465.

Tuberculous Warts

(Anatomical Warts)

Warts of definite tuberculous origin are not altogether uncommon in children. They can be treated on the general lines indicated for lupus (page 488), or locally on the lines described under the Common Wart (page 522).

DISEASES OF THE SKIN DUE TO SYPHILIS

In syphilis, skin lesions occur at all stages of the disease. First, in the acquired form, there is the primary chancre, which develops at the seat of inoculation a few weeks after infection has occurred, and lastly, there is the ulcerated gummata which only occur in the tertiary stages of the disease. The lesions are so protean in character that it is almost impossible to enumerate them, but they have certain characteristics in common which help to distinguish them from other skin affections of different origin. In the first place they are polymorphic in type; they tend to be coffee or " raw ham " in colour; they are generally hard; their configuration may be serpiginous, gyrated, or concentric, and although generally discrete, they sometimes coalesce. They may involve the face, trunk, or flexor aspects of the limbs, and they attack the hair and nails as well as the epidermis itself. In the final issue, however, the diagnosis must depend on the discovery of the specific organism in skin scrapings, or by a positive Wassermann test.

Treatment.

Prophylactic. Although in the case of children syphilis is usually of congenital origin, it may occasionally be acquired directly or indirectly from infected persons, through the medium of towels, drinking vessels, articles of clothing, kissing or even by illicit sexual acts. Prevention, therefore, includes all the precautionary measures which are calculated to avoid such modes of infection. Persons suffering from the disease should be warned that they are a source of common danger to others, and should be persuaded to submit to early and energetic treatment on specific lines.

In the almost inconceivable circumstance of it being known that a child has been exposed to a definite source of infection,

the prophylactic measure of applying a 30 per cent calomel ointment and rubbing it well into the site of inoculation, can be confidently relied on to prevent the development of the disease, that is to say if the remedy is applied within a few hours of inoculation.

Specific Serum Treatment. So far no anti-syphilitic serum or vaccine has been made available for use, either as a prophylactic or as a cure of the disease.

Curative. The general treatment is the same as that described for congenital syphilis (page 162). Local treatment of the skin lesions will not as a rule call for any special attention, so long as the blood condition is treated on specific lines, but chancres, if they exist, as well as mucous patches in the mouth, and anal condylomata, require special attention. Chancres should be treated with iodoform ointment, while mucous patches in the mouth should be cauterized daily by an application of a 5 per cent solution of chromic acid, and the mouth kept as clean as possible by an antiseptic mouthwash, such as Dakin's solution (Liquor sodæ chlorinatæ chirurgicalis, B.P.) in a dilution of 1 in 10. In the treatment of anal condylomata, the secret of success consists in keeping the parts as clean and dry as possible by careful washing, and by the free application of a good talc powder combined with calomel (1 part in 20) and sub-nitrate of bismuth (1 in 15).

SKIN DISEASES OF ALLERGIC ORIGIN

It is with considerable hesitation that I attach the label of " Allergic " to two such important and common varieties of skin disease as nettlerash and eczema but there appears to be no alternative.

By the term " Allergic " is meant a special hypersensitiveness of the tissue cells to certain environmental stimuli of a chemical, mechanical, or possibly psychological order, which results in a somewhat violent reaction. This tendency may be inherited or acquired, and quite apart from the reactions which result in skin lesions, reactions may occur in other parts of the body to all these forms of allergic stimuli. Such typical reactions are those of hay fever and asthma.

Urticaria

In one form or another urticaria is the commonest of all skin diseases of childhood. Very few individuals reach adult life without having passed through at least one attack of papular urticaria.

Urticaria in childhood takes many forms, but all of them are probably only varieties of one and the same disease.

The etiology of urticaria has at different times, and by different authorities, been ascribed to teething, indigestion, nervous disturbances, infections, or hypersensitiveness of the tissue cells to certain foreign substances, such as foods, drugs, or even to psychological or mechanical stimuli. If we admit that in urticaria the skin reaction simply represents a somewhat exaggerated response to almost every kind of stimulation, we can understand why so many different explanations of the exciting cause have been suggested.

Although in its classical form urticaria is characterized by the development of transient white wheals which are surrounded by a red areola, and are very similar in appearance to the wheals caused by the lash of a whip or the sting of a nettle, this is not the type of rash commonly met with in infants and young children. The form observed in the latter is usually papular, although under certain circumstances these papules may become bullous, vesicated or pigmented. The following account of the treatment of urticaria applies mainly to the common or papular form but with slight modifications is suitable for other varieties of the disease.

Papular Urticaria

(Lichen urticatus ; Strophulus ; Gum Rash ; Teething Rash)

In its typical form, this rash consists in infants and children not so much of a wheal as of an evanescent blotch with a central deep-red papule which persists after the macule has disappeared, and later becomes vesicated, umbilicated or covered with a scab. If scratched or otherwise damaged, the papules may become secondarily infected, undergo ulceration, and thus lose a good deal of their primary characteristics. The lesions occur for the most part on the back, loins, and abdomen, as well as on the extensor surfaces of the limbs, but they avoid the face and the scalp. They frequently appear in groups of a somewhat characteristic linear or " grid-iron " pattern. The alignment of the spots however does not correspond with the course of the superficial nerves, as in the case of herpes, and by this means the two conditions may be distinguished.

From the spots of chicken-pox they may also be distinguished owing to the fact that unlike the latter, they practically never attack the mucous membrane of the mouth. The outbreak of the rash is seldom accompanied by any severe constitutional symptoms, but there is nearly always a good deal of nervous irritability and itching.

The essential cause of the rash is now generally believed to be a local production of histamine, or some closely related substance, which induces in the first place a capillary dilatation, and then an increased permeability of the vessel wall, followed by areolar flushing and wheal formation, and that the liberation of this toxic substance is due to a reaction between the hypersensitive cell and some special allergen. Whether this is so or not, this view of the pathogenesis offers an understandable explanation of most of the phenomena connected with the production of, and with the successful treatment of the condition.

The predisposing causes of papular urticaria are :

1. The age of primary dentition, that is to say, between 6 months and the end of the 2nd year.
2. Warmth of any kind due to excessive clothing, or climate.

The exciting causes may be external or internal. Of the external causes, the bites and stings of insects, and the hairs of caterpillars are common examples. Amongst vegetable irritants must be included nettles, cowhage, tomato leaves, hybiscus, and the primula obconica. Amongst physical irritants the most common are scratching, rubbing, friction, heat, or cold. Of internal causes the majority are toxins connected with food or bacteria. Among the varieties of food most likely to be responsible for attacks are shell-fish and pork. The administration of anti-toxin and autogenous toxins of all kinds may also produce the same result.

Nervous disturbances of a psychological nature, such as strong emotions, anger, fright, excitements, or fear, are occasional causes of the rash.

Treatment.

Prophylactic. The prevention of urticaria consists in avoiding any of the known causes which are concerned in the etiology of the disease. In my experience the nervous disturbances which are brought about by teething are more frequently than any other known cause concerned in the production of papular urticaria. Although, of course, it is impossible to eliminate this predisposing factor, its results may be largely mitigated by the sedative action of the bromides on the central nervous system. I have found that large doses of this drug, not the small doses of 2 or 3 grains usually employed, but really large doses of 5 or 6 grains, have a better influence in preventing the development of urticaria in susceptible children than almost any other prophylactic procedure, and this therapeutic measure should be resorted to in all cases in which there is any likelihood of an attack

occurring, though naturally all other sources of internal or external irritation should be sought for, and if possible avoided.

Curative Treatment. *Feeding.* As regards food, there is practically no variety which has not at one time or another been incriminated as a responsible etiological factor, and as such considered to be contra-indicated for children susceptible to urticaria. Protein hypersensibility certainly occurs in urticaria, but it is impossible to eliminate all representatives of this class, more especially milk proteins, from a child's dietary, even in very bad cases of urticaria which are believed to be due to such causes. I feel convinced that too much has been made of this type of hypersensitiveness as a causative factor in urticaria. Since however proteins lose their specific characteristics, and consequently their specific properties as allergens when they are digested or resolved into peptones, or into their component amido acids, cases of urticaria due to, or associated with protein hypersensibility are rationally treated by gastric digestives, such as pepsin and hydrochloric acid, which promote digestion in the stomach, or by the peptonization of such foods before they are consumed. On the other hand the tendency at the present day is to regard fats, and especially bacon fat, with suspicion, and Dr. G. W. Bray recommends the elimination of pig fat from the diet of children suffering from urticaria, on the ground that the latter may be due to this form of hypersensibility. My own experiences do not coincide with this view, although in certain cases the limitation of fat of any kind may be of advantage.

Excess of carbohydrate or the taking of certain varieties of cereals is also regarded by some authorities as a cause of urticaria, and therefore contra-indicated. I have seldom found the limitation of carbohydrate food below the ordinary physiological threshold of tolerance of any advantage in the treatment of this skin disease. All the same, in the management of urticaria it is always wise to make careful inquiry for any existing food idiosyncrasy, as also for any infringement of the ordinary canons of physiological feeding or balance.

De-sensitization. If by means of skin inoculation tests it is discovered in any particular case of urticaria that the sufferer has a marked hypersensibility with respect to any particular article of food, the latter should be omitted from the dietary if it is at all possible, but if it consists of some almost indispensable food factor, such as milk or eggs, special steps should be taken to bring about tolerance by de-sensitization methods—that is to say, by the hypodermic injection of graduated doses of a sterile solu-

tion of the particular food element at fault, if it is capable of being rendered soluble. To do this very small quantities must be used at first, and increased gradually until complete toleration is obtained. For further particulars of methods of desensitization see page 720.

General Treatment. The general treatment of cases of papular urticaria includes the sedative treatment of the central nervous system, the raised excitability of which almost invariably accompanies this affection, and may be as much its cause as its result. Every possible source of psychological excitement should be inquired into, and if found, avoided, while bromide of ammonium should be given in large doses in combination with other drugs presently to be described as specifically indicated under such circumstances. Reflex irritation of the central nervous system due to constipation, worms, wind, colic, or other forms of indigestion must be treated by appropriate means, and above all, by suitable therapeutic measures, while the possibility of coexisting intestinal toxæmia must be considered, and if found to be present, treated by methods of intestinal antisepsis.

Quite apart from reflex sources of irritation of the central nervous system connected with psychological or digestive disturbances, other forms of irritation may play a part in the etiology, as for instance, troubles of the genito-urinary system, or lesions of the skin itself, such as scabies, or pediculosis.

At one time calcium therapy was believed to be indicated for all cases of urticaria, and calcium lactate for a long time enjoyed a high reputation in this respect. More recently this line of treatment has fallen into disrepute, perhaps undeservedly, for the spasmophilic state associated with a low calcium content of the blood (Status calciprivus) is a factor in nervous excitability and possibly in urticaria also, which must be reckoned with, and as such, treated by calcium medication. For this reason I strongly advise the inclusion of calcium, especially in the form of the lactate, and glycerophosphate in the combination of drugs which I suggest is suitable for the majority of cases of urticaria. The employment of gluconate of calcium is referred to later.

Speaking quite generally, the indications for drug treatment are as follows :

Sedatives such as the bromides for allaying nervous instability :

Rhubarb, soda, and petroleum to deal with intestinal troubles :

Calcium to counter possible spasmophilic complications. All these drugs may be combined in one and the same formula, such as the following, which is the one I generally employ :

Bromide of Ammonium	6 gr. (0·4 gm.)
Tinct. of Rhubarb	5 minims (0·3 c.c.)
Bicarbonate of Soda	5 gr. (0·3 gm.)
Citrate of Potash	5 gr. (0·3 gm.)
Lactate of Calcium	5 gr. (0·3 gm.)
Glycerophosphate of Calcium	2 gr. (0·13 gm.)

Semprolin Emulsion with Phenolphthalein to make 1 fluid drachm (3·5 c.c.).

One dose should be taken at mealtimes, three times a day, by an infant 1 year old.

In cases of special severity, or in emergencies, there are two lines of treatment which can be relied upon to give good results both in allaying the irritation of the rash and in promoting a cure. The first of these is the hypodermic injection of ½–1 minim (0·032–0·06 c.c.) of adrenalin solution (1 in 1000). This gives striking and immediate relief to the irritation, but the effect is not maintained, and the injection has to be repeated at fairly frequent intervals. The second method consists in the intramuscular injection of gluconate of calcium. This should be given in the form of a 10 per cent sterilized solution (B. D. H., Ltd.) to the extent of 32 minims (2 c.c.). The dose should be repeated daily. In the bullous variety of urticaria this last-named method often gives very excellent results.

Local Treatment. This consists in protecting the skin from scratching or other forms of damage, and in allaying the irritation by soothing applications. As a rule there is no need to cover up the spots by bandaging or other means so long as the child cannot reach them with his hands and lacerate them by scratching.

As far as the lesions themselves are concerned, provided they have not been damaged by scratching or have become ulcerated or secondarily infected, I prefer an ordinary calamine lotion to the more usual one of carbolic acid and tar, since on drying it affords a protective coating. The formula of the lotion that I generally employ is as follows:

Lotion of Subacetate of Lead	2 oz. (60 c.c.)
Tincture of Opium	½ oz. (15 c.c.)

Lotion of Calamine (B.P.), to make 6 oz. (170 c.c.).

If carbolic or tar lotions are employed, they should be dabbed on and allowed to dry, and the area of skin thus treated subsequently dusted with a good talc powder.

Dr. Morris Witkin strongly recommends an ointment consisting of:

Hydrochloride of cocaine	2½ gr. (0·16 gm.)
Camphor	15 gr. (0·9 gm.)

to the ½ oz. (15 gm.) of some simple ointment base:

to be well rubbed into the irritated parts. This counteracts the extreme pruritis, and there is no fear of any undue absorption of cocaine.

Giant Urticaria

(Angio-neurotic Œdema)

Although this particular variety of urticaria is not very common in children under 5 years of age, nevertheless, attacks of it, when they do occur, are very alarming. I have twice been called up in the middle of the night to see infants who have suddenly developed large angio-œdematous swellings of the face, and which in one case entirely closed up one eye. In both these cases the swelling had disappeared before I arrived, and this is the general rule, the œdema is of a very transitory type. Although the affection is almost certainly allergic in origin, it is equally certain that it is closely associated with disturbances of the nervous system, and most probably of the sympathetic system, indeed it has been regarded as a sympathetic neurosis. Every case that I have seen in infants has occurred at times of teething, indeed, I have come to regard it as a not altogether unusual manifestation of dentition.

Treatment.

Prophylactic. Since recurrences are the rule rather than the exception, it is important to discover if possible the particular etiological factor to which the attack is due. Since in infants and young children dentition or some other nervous disturbance is the common cause, in these cases in which an attack has once occurred, the prevention of others should take the form of allaying any nervous instability which may co-exist with dentition by means of the administration of nerve sedatives, especially the bromides. If, however, any special article of diet, such for instance as egg, can be held suspect, it should either be excluded from the dietary, or given with extreme caution during periods of nervous disturbance when the child may be held to be peculiarly susceptible to all pathological forms of stimuli. Although calcium cannot be regarded as a specific for this variety of urticaria, it is in my experience decidedly useful as a prophylactic, and probably for the reasons given under the heading " Papular Urticaria " (page 492). If by skin tests or other means, hypersensitiveness to any particular protein or article of food can be discovered, steps should be taken to effect de-sensitization by one of the methods described on page 720.

Curative. The effect of adrenalin therapy is so good and reliable in cases of this particular variety of urticaria, that there is no need to describe other methods, such as the giving of ephedrine, calcium gluconate, or calcium lactate, which have established

reputations in the treatment of other forms of the affection : ½ to 1 minim of (1 in 1000) solution of adrenalin, should be injected hypodermically at the earliest possible opportunity. Usually within a few minutes the œdema will commence to subside and will have disappeared in the course of a few hours.

Eczema

As far as children under 5 years of age are concerned eczema generally takes the so-called " infantile " form (Eczema Infantum), and this variety, if not all others, is now commonly included among the " allergic " skin diseases. Although more often than not it is the result of an extension of some pre-existing dermatitis, especially seborrhœa of the scalp, or papular urticaria, as a rule it only develops in specially susceptible infants of the allergic type. Eczema infantum is now usually regarded as due to external irritation of the skin, occurring in children who are particularly susceptible to all forms of stimulation. In support of this view most infants liable to eczema also show evidence of the irritability of their integuments by the development of dermographic phenomena on very slight provocation, such as drawing the nail across the skin, and a liability to contract sores in the folds of the skin and behind the ears where moisture, and especially soapy water, is apt to accumulate, and whence it is difficult to remove. Eczema of this kind nearly always commences in the parts which are exposed to the greatest degree of irritation, namely, the scalp, forehead, face, behind the ears, and in the folds of the skin, and having once started in these situations it is extremely liable to extend owing to scratching or secondary infection.

From the point of view of treatment, both prophylactic and curative, an understanding of the etiological factors concerned in the production of eczema is of basic importance, and for this reason the pathogenesis of the condition should be reviewed in all its aspects. In the first place hypersensitiveness of the skin to all forms of external or internal irritation must be taken as the basis of the pathology. This sensitiveness of the skin may be inborn and hereditary, or acquired as a result of sensitization to special allergens, or indeed, it may result from these two factors combined. Hypersensitiveness of the skin is however only an expression of the hypersensibility of the nerve cell which is the dominant factor in the reflex act. These exaggerated dermatological reactions in eczema are due rather to the susceptibility of the nerve cells than to any particular vulnerability on the part of the skin itself. The degree of excitability of the whole of the central nervous sphere as well as that of all its component cells,

is largely dependent on the environmental conditions of nutrition and stimulation, as well as on the condition of the blood, and on the presence or absence of circulatory toxins. Hence it is easy to understand how one person may interpret an attack of eczema as due to indigestion, another to infection, another to purely nervous causes, another to external irritation, and yet another to protein hypersensibility.

Treatment.

Prophylactic. The preventive treatment of eczema must be conducted on lines which take into consideration this large number of etiological possibilities. Since almost any single form of dermatitis, such as papular urticaria, seborrhœa, or lichen planus, may in susceptible subjects develop into a genuine eczema involving the greater part of the body surface, it is clear that the prophylaxis of eczema involves the energetic treatment of all these conditions on their very first appearance. In children I would emphasize the tendency there is for the neglected or improperly treated cases of seborrhœa capitis to spread over the forehead and face, and finally constitute a general eczema of the whole body. All cases of seborrhœa infantum should be regarded seriously, and treated as possible forestages of eczema infantum. Further, I may call attention to the great liability of the face, the situation in which eczema generally starts, to suffer from irritation due to exposure to changes of temperature, to the effects of cold winds, soap and water, rough and imperfect drying, and rubbing against the clothing of the mother. These sources of irritation may very easily work up a mild erythema into a dermatitis, and finally into an eczema.

Then again, food idiosyncrasies which are responsible for so many urticarial reactions, may if neglected also lead to eczematous complications. Indigestion is one of those forms of reflex irritation which must be reckoned with as a predisposing cause of eczema : so also is intestinal toxæmia, which by reason of circulating toxins raises the irritability of the nerve cells, and for this reason must not only be included as an important factor in the etiology of eczema, but must receive due attention from the point of view of prophylaxis. All psychological factors or other events which indirectly predispose to excitable states of the central nervous system and of the vasomotor system in particular, are potential sources of eczema in susceptible subjects, because they increase the irritability of the nerve cell, and as such must be taken into account in any rational prophylactic line of treatment.

Curative. It has been stated that the treatment of eczema

can be summed up in three words—" protection from irritation "—meaning of course, protection of the skin itself, but such advice, satisfactory as it is from most points of view, does not take into account the equally important task of protecting the nerve cell itself, and of taking into consideration the possibilities of allergic complications.

The treatment of eczema very naturally resolves itself into two distinct parts.

(1) The general treatment of the case.
(2) The local treatment.

(1) General Treatment. This is by no means the least important or the easiest part of the treatment. It involves in the great majority of cases confinement to bed, under conditions in which the child is protected from cold, and kept at a suitable temperature, and in a position in which it is possible to prevent scratching, an absolutely essential element in the cure. This desideratum can be secured in several ways, by pinning the sleeve of the sleeping garment to some fixed point, such as the napkin or the mattress, or by splinting the arm at the elbow with cardboard, and thus preventing the hand reaching the irritated parts.

Feeding. Unless there is any definite evidence of food idiosyncrasy or protein hypersensibility, which is very rarely the case, the feeding should be conducted on ordinary lines with due regard to the physiological principles of balance, digestibility, and quantity. There is no evidence to show that eczema is, properly speaking, a dietetic disorder, although the reflex consequences of indigestion are sometimes clearly evidenced in the raised excitability of the central nervous sphere, which is itself a predisposing cause of eczema. Moreover, the direct influence of poisons produced in intestinal toxæmia acting on the nerve cell also may contribute to the same result. It is a common experience that over-feeding, by predisposing both to indigestion and intestinal toxæmia, is itself a contributory cause of eczema.

Sleep. With eczema the raised excitability of the central nervous system usually interferes with sleep, and want of sleep intensifies the nervous irritability, thus contributing to a vicious circle of events which must be broken by some suitable means, if a cure is to be effected. In spite of the fact that bromides themselves may give rise to a dermatitis of their own, I believe that there is no drug for internal administration which has anything like so good an effect as a sedative. Bromides must however be given in full doses. For preference I recommend the bromide of ammonium, and from 5 to 10 grains three times a day

is not too much. It may be given in combination with other drugs, which may be indicated for the treatment of the intestinal condition. The formula given on page 496 in the treatment of papular urticaria also serves in cases of eczema.

Washing. Both soap and water are contra-indicated for eczematous skins, but may occasionally be obligatory. Under such circumstances only super-fatted soaps should be employed and if possible only rain water. In drying, friction of any kind should be avoided and the process carried out by dabbing or patting. As a matter of fact it is far better to avoid washing with water altogether, and to keep the skin clean by sponging with pure liquid petroleum, which also may be used for giving an actual bath.

Internal Drug Medication. There is no drug for internal administration in cases of eczema which can under any circumstances be regarded as specific. Such drugs as arsenic, ichthyol, calcium lactate, or sodium bicarbonate, if they have any value at all, it is only in the treatment of predisposing causes or concomitant symptoms. They have no effect on the primary trouble.

Climatic Treatment. In the acute stages of eczema a mild or moist inland and sylvan climate is indicated, the salt-laden air, strong winds, bright sunlight and glare of the seaside are too stimulating to the hypersensitive skin, and as such are to be avoided. In the later stages of the disease these stimulating properties may have some value.

(2) Local Treatment. The end all and be all of local treatment is to protect the skin from irritation, and thus help the "*vis medicatrix naturæ*" to complete its beneficent task without let or hindrance. It is extremely doubtful whether any of the greatly vaunted specifics for the local treatment of eczema have any other effect than this. To apply, however, the appropriate protective means to the eczematous skin in its various phases of development at the right moment and in the right manner, calls for the highest display of the physician's art. In the evolution of a typical case of infantile eczema the following stages may be recognized :

(*i*) The erythematous stage, in which there is vascular dilatation, and vascular irritability, and sometimes a temporary œdema.
(*ii*) Papular or infiltrative stage.
(*iii*) Vesicular or weeping stage.
(*iv*) The exfoliative, lichenified, indurated and cracked stage.

These various stages of progressive development may exist side by side, or follow one another in due order. On the other hand, with successful treatment they may be aborted at any stage and never give further trouble. What however is quite definite as regards local treatment is that each stage requires its own special method of treatment. I well remember a very bad case of eczema which I was called upon to treat at the beginning of my professional career, and for which I sought the help of Dr. J. H. M. Macleod. This case showed a great multiformity of lesions exemplifying each one of the above stages, and for each of these Dr. Macleod had a special line of treatment and a different local application. In the end the result was most satisfactory, and in my own practice I have ever since attempted to act upon the same therapeutic principle, that is to say, to treat each phase of the disease as a special problem.

(*i*) *The Erythematous Stage.* Treatment of this phase of the disease is important, and its successful accomplishment opens out the possibility of preventing the further progress of the disease, or the development of more serious symptoms. The indications for treatment are to prevent scratching and to allay the irritation and heat of the skin by some such evaporating and soothing lotion as one consisting of sub-acetate of lead, calamine, and tincture of opium, in the proportions stated below. It is to be applied to the affected areas of skin on pieces of lint or butter cloth, but otherwise left freely exposed so as to encourage evaporation. As the face is the most common seat of infection, a suitable mask should be shaped and kept in position by tapes tied round the back of the head.

Prepared Calamine	1½ drachms (5·4 gm.)
Oxide of Zinc	1 drachm (3·6 c.c.)
Tincture of Opium	½ oz. (15 c.c.)
Solution of subacetate of Lead (B.P.)	2 drachms (7 c.c.)
Water to make 6 oz. (170 c.c.)	

(*ii*) *The Papular Stage.* The indications for the treatment of this stage of eczema are very much the same as those for the preceding one, that is to say, the prevention of scratching, and the allaying of irritation. The two drugs which in my experience serve the latter purpose best are resorcin and tar. A combination of the two is generally preferable to either of them employed separately, with this reservation however, that different skins react differently to one and the same local medicaments, so that should such a combination fail in its purpose, it should immediately be changed for an ointment containing only one of these drugs, or

possibly some totally different drug, such as calamine or ichthyol. The formula for the combined ointment is as follows :

Resorcin	35 gr. (2·1 gm.)
Birch Tar	35 gr. (2·1 gm.)
White Wax	80 gr. (4·8 gm.)

Soft Paraffin to make 1 oz. (30 gm.).

The addition of 35 gr. (2·1 gm.) of zinc oxide, and the same amount of sub-nitrate of bismuth, is I think an improvement. The well-known proprietary article Resinol, is an elegant ointment containing very much the same ingredients as the above, and although as a rule I prefer to prescribe my own formula, I have several times found Resinol succeed when my own prescriptions have failed.

(*iii*) *Vesicular Stage.* This is much the most difficult stage of eczema to treat successfully. With a weeping surface, greasy applications are contra-indicated, as they do not mix with the serous discharge and consequently cannot come into contact with the affected tissues. For this reason watery preparations of some kind are preferable, such as those of tar, resorcin, acetate of lead, or nitrate of silver. Lint well saturated with a weak solution of any of them should be applied to the raw surface. In view of the great liability of secondary infections in so good a culture medium as the serous discharge of a weeping eczema, an antiseptic should always be added to whatever lotion is employed, but it is imperative that this should possess non-irritating properties. I have found 1 per cent solution of Gentian Violet, 10 per cent solution of Dettol, or a 1 in 300 solution of Monsol, suitable for this purpose.

Although the lines of treatment above described for the weeping stage are the ones usually adopted, I have recently come to the conclusion that the same method of treating the raw surfaces of a weeping eczema as that now usually employed for the granulating surface of a burn, gives still better results, and I have been encouraged in this belief by observing the excellent results which follow the treatment of sore buttocks by means of tannic acid and alcohol, a method of treatment which one would hardly imagine would be suitable in the case of really raw surfaces. I began this line of treatment in a tentative way, applying it only to small areas at a time, but I have found it so successful that I now deal with large surfaces with the greatest confidence. The details of treatment are as follows :

A piece of butter-cloth of the required size to cover the weeping surface is thoroughly soaked in a 5 per cent aqueous solution of

tannic acid, freshly prepared, and this is laid lightly on the affected part, and changed every 3 or 4 hours until a brownish crust forms. This should be left undisturbed for as long as possible. The leathery coagulum thus formed in the case of burns is thought to render the toxins produced by the damaged tissue cells inert and unabsorbable, and possibly the same applies in the case of the weeping surface of eczematous skin. Whether these claims are justified or not, it is quite certain that the method is well worth trying. Secondary infections during the weeping stage may be treated by anti-staphylococcic and anti-streptococcic vaccines, or by the local application of antipeol cutaneous vaccine in liquid form (ampoules).

(*iv*) *The Chronic Indurated Stage.* During this stage the emollient properties of a slightly stimulating ointment are indicated, and for this purpose a 20 per cent ichthyol ointment is well suited. It has to be thoroughly rubbed into the affected parts and kept in contact with the indurated skin by suitable dressings and bandages.

Particularly chronic patches of itching and lichenified skin are best treated by a pastille dose of X-rays, which may be repeated if necessary at intervals of one month.

Pompholyx

(Cheiro-pompholyx ; Dyshidrosis)

This disease consists in the development of a number of deep-seated vesicles about the size of sago grains on the hands and feet. The rash is accompanied by sensations of itching, burning, and tingling. As a rule the affection is accompanied by excessive moisture of the skin and sweating, but it is not now generally regarded as a disease of the sweat glands, but rather as a form of eczema. It is usually accompanied by mild constitutional symptoms, is apt to recur especially in the spring and early summer, and to affect more particularly debilitated and nervous children. Both heat and sunlight appear to be definite etiological factors.

Treatment. *Prophylactic.* Since heat and sunlight are the only two exciting or predisposing causes of pompholyx of which we have knowledge, prevention naturally consists in avoiding these two etiological factors. Every effort should be made to keep the feet and hands as dry as possible by the use of astringent applications, especially tannic acid in alcoholic solution (1 in 8). This should be dabbed occasionally on the hands and feet and allowed to dry in the open air. Subsequently the skin should be

dusted over with a powder consisting of talc and tannigen (1 in 4). This may be kept in contact with the skin of the hands by means of porous cotton gloves, and in the case of the feet by thin socks.

Curative. General treatment consists in dealing suitably with the underlying condition of debility. Good food, change of air, suitable clothing, are all matters which must be taken into consideration. Local treatment consists in keeping the diseased parts dry and free from exposure to heat of any kind. The affected skin should be dusted with powder consisting of talc and tannate of zinc (1 in 4). The involved parts should be washed as little as possible, but in severe cases with ulceration, the skin should be kept clean with a weak solution of permanganate of potash, or peroxide of hydrogen, and then thoroughly dusted with talc and tannoform powder (1 in 4).

Psoriasis

This consists in the development of reddish or reddish-brown macules, which are at first about the size of a pin's head, and are covered with white glistening scales, which may be rendered more conspicuous by gently scraping with the finger-nail. The lesions extend peripherally to about the size of a five-shilling piece, but seldom larger, although individual patches may coalesce and form circinate areas of considerable size. The common sites of the lesions are the knees, elbows, scalp, and extensor surfaces of the limbs. There are few indications of any constitutional disturbance, but there may be some itching. The nature of the disease is unknown, though heredity clearly plays some part in providing a suitable soil for the development of the lesions, or possibly for the life of some specific microbe or virus.

Treatment.

Prophylactic. As the etiology of the disease is unknown, there is no rational means of preventing its occurrence; neither diet, climate, clothing, nor exercise, appear to have any influence on its occurrence, nor on the course it pursues.

Curative. As in the prevention, so in the cure of this disease, none of the ordinary hygienic measures so often useful in other forms of skin disease appear to have the least influence. A very bad case must be immobilized in bed, and nervous symptoms treated by sedatives on the ordinary lines. The only drugs that have retained their reputation in the treatment of this disease are arsenic and thyroid, but neither of them has any specific action, while both of them must be employed with considerable circumspection.

No serological method has so far been advised which is of any avail, and Spa treatment, though beneficial from the point of view of general health, appears to have very little effect on the local condition.

Local Treatment. This consists first in removing the scales by repeated washing with soap and water, and scrubbing the denuded areas with a soft nail-brush. Subsequently the lesions must be treated with a suitable ointment, which may consist of resorcin, ichthyol, oil of cade, or salicylate acid. The application of chrysarobin, so reliable for older individuals, is contra-indicated in the case of young children. The following combination of salicylate acid, oil of cade, and resorcin, will be found useful in the majority of cases :

Salicylate Acid	10 gr. (0·6 gm.)
Oil of Cade	1 drachm (3·5 c.c.)
Resorcin	10 gr. (0·6 gm.)

Vaseline to make 1 oz. (30 gm.).

No case can be considered cured as long as there are any traces of the lesions visible, a point which seems to support the view that the disease is of infective origin.

Lichen Planus

The term " Lichen," after undergoing many vicissitudes as regards meaning and interpretation, is now reserved for a few cutaneous diseases of the lichen planus type, consisting essentially of an inflammatory papule, polygonal in shape, varying in colour from light red to lilac, and tending to form by coalescence irregular patches with rough scaly surfaces. The term as now used does not apply to lesions of primary tuberculous, syphilitic, or urticarial origin, in which lichenification has taken place.

Lichen planus occurs in two forms :

1. As a sub-acute or chronic localized disease.
2. As an acute generalized disease.

1. Chronic or Sub-acute Localized Type.

Although this is the common form of the disease, it is seldom found in children under 3 years of age. It presents a great many different morphological aspects to which descriptive epithets, hypertrophic, horny, annular, linear, erythematous, bullous, and herpetic, have been applied, to signify the special character of the lesion. The cause of the disease is still unknown : by some it is regarded as a nervous disease like herpes zoster ; by others it is looked upon as of toxic or infective origin. A critical review of the circumstances under which attacks occur

would appear to support both views, for the disease certainly tends to develop in children of the nervous type. Indeed, it is sometimes associated with herpes zoster, and it occasionally has a distribution which corresponds with the course of a cutaneous nerve. On the other hand, it is sometimes associated with constitutional symptoms such as are usually met with in exanthematous or other infective disorders.

The disease has to be distinguished from eczema, psoriasis, and seborrhœic dermatitis, from all of which it differs by the angular outline of the papules, by the flatness of their surface, by their coloration, and the characteristic horny depression or plug in the centre of the macules, also by the affinity of the latter for the extensor surfaces of the arms and thighs, by their avoidance of the palms of the hands and the soles of the feet, and also by their not infrequent invasion of mucous surfaces.

Treatment.

Prophylactic. As the etiology of the disease is not known, there are no prophylactic measures of a rational order for avoiding its occurrence.

Curative. The general treatment consists in allaying the symptoms to which the irritation of the skin may give rise, or to which the latter may be due. This may be best effected by hygienic measures such as change of air, good feeding, regular exercise, and suitable mental occupation or distraction.

Drug Treatment. This consists in the giving of nerve sedatives, such as the bromides, or nerve tonics such as glycerophosphate of calcium, or nuclein preparations. Arsenic may be useful in the more chronic cases, but is not indicated during the active stages. Antipyrine (gr. 1) is distinctly useful in very acute cases with much skin irritation. I do not recommend either mercury, quinine, or salicylate for internal administration.

Local Treatment. In the really acute cases the chief indication is to allay irritation and irritability, and thus obviate the necessity for scratching. Sedatives and cooling lotions are indicated rather than ointments, and for this type of case the following will be found useful:

Carbolic Acid	5 minims (0·3 c.c.)
Prepared Calamine	1 drachm (3·9 gm.)
Solution of Acetate of Lead (B.P.) . .	10 minims (0·6 c.c.)

Water to make 1 fluid oz. (30 c.c.)

This lotion should be applied to the skin on lint or gauze.

For the commoner type of case, that is to say, for the subacute or chronic conditions, a more appropriate application

consists of an ointment containing mercury, zinc, or resorcin. The following formula for sub-acute cases will be found useful:

Resorcin	35 gr. (2·2 gm.)
Carbolic Acid	5 minims (0·3 gm.)
Dilute Ammoniated Mercury ointment .	1 drachm (4 gm.)
Zinc ointment to make 1 oz.	(30 gm.)

For the chronic, hypertrophic, or verrucose lesions, which indeed are very rare in children, plasters are a very convenient form of applying the stronger medicaments which are necessary to deal with such indurated conditions of the skin. The compound salicylate plaster (B. P. C.) or the mercuriated plaster (B. P. C.) will be found serviceable, but for the really intractable chronic cases X-ray treatment is better than the local application of pharmacopœal preparations, and a full Sabouraud pastille dose should be given to each lesion, the surrounding healthy skin being protected by lead foil or lead sheeting.

DISEASES OF THE SEBACEOUS GLANDS

The diseases of the sebaceous glands, or pilo-sebaceous follicles, include seborrhœa, comedones, and acne vulgaris. The function of the sebaceous glands is to secrete sebum for the lubrication of the shafts of the hairs, and their protection against air or water. When the secretion is excessive an unduly greasy condition of the skin results, which gives rise to an unpleasant mousey odour, and provides a suitable culture medium for pathogenic organisms which may produce a dermatitis. On the other hand a deficient secretion of sebum due to atrophy of the glands or other causes produces a definite brittleness of the capillary shafts, falling out of the hair, and dermatitis, owing to loss of protection against water and other external irritants.

Seborrhœa

(Seborrhagia)

At no age period is seborrhœa in itself a disease of great importance, although in adolescents and adults the greasy condition of the complexion often conduces to a good deal of personal annoyance. Excessive secretion of sebum may serve as a predisposing factor in the development of several well-known groups of cutaneous diseases, including seborrhœa capitis, seborrhœic dermatitis, comedones, and acne vulgaris, but in infants and children it creates little trouble beyond giving rise to small fatty plugs in the pilo-sebaceous follicles, chiefly on the cheeks, forehead, and

chin, a condition which is known as miliary sebaceous acne, which is a fairly common condition in early infancy.

Treatment. *Prophylactic.* Undue greasiness of the skin is dependent more on hereditary and familial tendencies than on any environmental circumstances, but over-feeding, especially as regards the fatty elements of a dietary, is definitely a causative or predisposing factor, and as such must be taken into account in the prophylaxis.

Curative. The excessive secretion should be removed from the surface of the skin by very thorough washing with soap spirit (spiritus saponatus), or spirit of potash soap, the spiritus saponis Kaleni of Hebra. Afterwards energetic friction should be applied by a soft Turkish towel or similar material in order to empty the sebaceous ducts of any retained or dried secretion.

Comedones

(Blackheads)

The formation of so-called blackheads depends on the blocking of the pilo-sebaceous follicles with a horny, sebaceous material. The black colour of the free end of the plug is not due exclusively to dirt, but mainly to a diffuse pigment associated with the cornification of the horn cells. This condition is more common at the time of puberty, especially in boys, but it occasionally disfigures the skin of quite young children, or even babies. The condition may be either inherited or acquired.

Treatment. *Prophylactic.* The presence of comedones is so often associated with such constitutional, blood, or digestive diseases as scrofula, anæmia, indigestion, constipation and intestinal toxæmia that the prophylaxis must take into account the predisposing influence of such conditions. Since excessive secretion of the sebaceous glands is a condition antecedent to the development of blackheads, the prophylactic treatment of seborrhœa as described in the preceding section must be regarded as a factor in the prevention of comedones. It has been suggested that the wearing of dirty caps, or the rubbing of the face against the contaminated skin or dress of the mother may be a possible etiological factor ; provision should be made against such contingencies.

Curative. This consists in the squeezing out of the inspissated secretion with the fingers, or with an expressor (or an old-fashioned watch-key), after softening the skin with a good lather of soft soap and hot water. The ducts should subsequently be kept free of secretion by the means suggested in the paragraph on the curative treatment of seborrhœa (see above). After drying,

the affected parts should be dusted with a good talc powder to which 20 per cent of precipitate of sulphur has been added.

Acne Vulgaris

(Folliculitis)

This disease is a pustular involvement of the pilo-sebaceous follicles, secondary to comedones, and due to infection with the acne bacillus (micro-bacillus), and the staphylococcus albus, either singly, or in combination. Although this skin condition is mostly confined to adolescents, and especially to boys about the time of puberty, the inflammation occasionally involves the grouped comedones of infancy, already referred to under the title " Miliary Sebaceous Acne " (see page 509).

The causes in infancy are unknown, but they are certainly not the same as those of the acne which occurs at the time of puberty, which are connected in some way with the activity of the hair follicles, and of the pituitary gland, but it is possible that they are associated also with loss of resistance to the Staphylococcus from enfeebled conditions of health.

Treatment.

Prophylactic. Preventive treatment involves the same procedures as those applicable in the case of seborrhœa or comedones, with the additional factor of raising resistance against bacterial infection in general, and staphylococcic infection in particular. The two drugs which have earned a reputation in the prophylaxis and remedial treatment of acne are sulphur and yeast, but whether they owe their efficacy to some direct deterrent action on microbic development in the body, or whether they act by improving the general condition of health by restricting intestinal toxæmia, or some such process, and thus raise the resistance indirectly, is still a moot point which is merely of academic interest.

Sulphur is best given to infants and young children in the form of the confection; 10 grains may be given three times a day, or a smaller dose of precipitated sulphur (gr. 1) may be easily administered in a little honey. Another way of administering sulphur is to give it in the collosol form—Crookes Collosol Sulphur 10 minims in a teaspoonful of water three times a day.

Curative. The general treatment of acne consists in attending to any disturbance of health which affects the digestive, secretory, or circulatory systems, especially intestinal toxæmia, and anæmia. The diet should be simple, and, as in the case of seborrhœa, strictly limited in amount. Over-feeding, especially with respect to fats, is probably one of the most prolific predisposing causes of both seborrhœa and acne.

Drugs. As in the prevention, so in the cure of acne, both sulphur and yeast are the drugs of election, and may be given in the same doses as recommended in the previous paragraph, but the intra-muscular injection of Collosol Manganese (Crooke's) in doses of 5 minims, and at intervals of 4 days, greatly augments the curative effect of the sulphur and yeast treatment.

Local Treatment. The local treatment consists in applying the same measures that are recommended under seborrhœa and comedones. Such treatment prevents potential centres of danger from becoming the actual seat of suppuration. Excessive secretion of sebum must be removed by frequent washing of the skin with an alcoholic solution of soap and water. Comedones must be expressed, and pus evacuated from each pustule with a suitable tenotome or bistoury. If this operation is skilfully performed, there is no pain or subsequent scarring. Boracic acid fomentations should be applied to the affected area, and these attentions to the skin should be repeated as long as the comedones continue to make their appearance. As in the treatment recommended for boils, the injection of one drop of pure carbolic acid into the centre of the infected spot by means of a very fine hypodermic needle may abort further progress in a threatening focus of infection. This treatment however should be used tentatively, and only pursued if it gives satisfactory results.

Specific Treatment. The specific treatment of acne by vaccine therapy is one of the most satisfactory in the whole domain of bacteriological methods. It is better to use a combination of compound stock and autogenous vaccine than either singly. The initial dose should be about 1 million of the acne bacillus and about 40 millions of the staphylococcus albus. The quantity should be gradually increased, and the injections continued at intervals of 1 week for about 2 months, or until the acne spots have ceased to develop.

DISEASES OF THE SWEAT GLANDS

The sweat glands of infants and children are subject to quite a large number of morbid conditions, both congenital and acquired. For instance, the secretion of sweat may be deficient (hypohidrosis), or entirely absent (anhidrosis), or excessive in amount (hyperhidrosis), or may possess some peculiar characteristic, such as offensiveness of odour (bromhidrosis), abnormality as regards colour (chromhidrosis), or it may contain some normal excretory product in excess, such as lactic acid or urea, and consequently give rise to skin irritation.

From the point of view of treatment few of these conditions require any special description. The following include only those with respect to which any special conditions apply.

Hyperhidrosis

(Excessive Sweating; Sudorrhœa)

Excessive sweating is a very common symptom, especially in infants in arms, but children between 1 and 5 years of age are by no means exempt. It is often described as a specific symptom of rickets, a view which in my opinion is entirely unjustified. It is a symptom of vasomotor instability, or sympathetic paralysis, which is certainly not a genuine element of the rachitic syndrome. It partakes somewhat of the nature of a habit, which like cold feet, or red cheeks, may be acquired as a permanent sympathetic or autonomic neurosis from frequent repetition. Apart from hereditary predisposition, this functional disturbance may arise in any pyrexial condition, no matter what be the cause, or from the action of toxins, acting on the sympathetic or parasympathetic systems.

Treatment.

Prophylactic. Since a vasomotor habit is in my opinion very largely at the root of this evil, prevention must lie in the early treatment of sweating, before it becomes habitual. Sweating is a protective reflex to bring about a rapid loss of heat in those cases in which an excessive rise of bodily temperature is threatened. The chief occasions when this protective reflex is called into play are in cases of over-feeding, and pyrexia from infective causes. It also occurs through the taking of diaphoretic drugs such as salicylic acid, antipyrin, phenacetin, aspirin, sweet spirits of nitre, and ammonium acetate. The frequent calling into play of this protective reflex may result in this very essential automatic reaction becoming over-developed. The avoidance or early treatment of all those causes which bring about hyperhidrosis must be taken into account in any line of prophylactic treatment. Apart from the avoidance of such causes of sweating as over-clothing, high room temperatures, and diaphoretic drugs, the most practical means of stabilizing the vasomotor system and thus preventing any tendency to undue sweating, is by the institution of a system of graduated cold baths. The tonic effect of these and their educational value on the vasomotor and heat-regulating centres is quite remarkable. Infants whose heat-regulating and vaso-motor centres are trained by such means very seldom experience chills and vagaries of bodily temperature, or disturbances of the

sweat functions. Baths of this kind should be given with full appreciation of their educational value, and not as part of the ablutionary ritual. The temperature of such baths should be systematically reduced day by day, from about 100° F. to about 62° F. Another method is to douche the skin after an ordinary warm bath with water which is gradually reduced in temperature, in the same way as is described above for the immersion bath. Such educational baths however should be reserved for the morning and not given at night, since they have a stimulant effect and may interfere with sleep.

Curative. The hydropathic treatment of excessive sweating as described above as a prophylactic measure is better than any attempt to counter the hyperhidrosis by anti-diaphoretic drugs such as atrophine, belladonna, quinine, or ergot, drugs sometimes employed for this purpose. Rational treatment however must include all the other methods which have been referred to under prophylaxis, especially the avoidance of over-feeding.

Local Treatment. This consists in the wearing of suitable clothing by night as well as by day. Cellular materials, such as Aertex, Meshlin, or Airlin (see page 447), which make provision for ventilation and evaporation, are indicated in contrast to clothes consisting of flannel or flannelette materials, which have a greater tendency to become damp by absorption and thus to keep the skin in a macerated condition. The skin should be freely dusted with a good talc powder, to which, if thought desirable, oxide of zinc may be added. Sponging of the skin with an astringent solution, or tannic acid, or alum, is also sometimes of use. The application of X-rays, if administered under expert direction, is also very useful in intractable cases, but it has hardly the same application as in the case of adults.

Bromhidrosis

Bromhidrosis, or the secretion of foul-smelling sweat is less common in infants and young children than in adults, but in certain diseases, such as cœliac disease or intestinal toxæmia, the bodily emanations often have a disagreeable and distinctive odour even in quite young infants. It is often claimed that this offensiveness of the integumentary secretions is due to the decomposition of normal constituents in the sudoral and sebaceous secretions set up by the Bacterium Fœtidum, or other organisms with putrefactive properties. Although this view may be correct under certain conditions, it is none the less more probable that in the majority of cases of bromhidrosis the offensive odour of the sweat is due to the failure of the hepatic de-odorizing functions, rather

than to decompositions in the sweat at the surface of the skin itself. These de-odorizing functions of the liver are amongst the most important of this organ, but they are subject, like its many other functions to great variations in efficiency. In cases of intestinal toxæmia, and especially in cœliac disease, these de-toxicating and de-odorizing functions are over-taxed, and break down, with the consequence that a variety of foul-smelling products of intestinal origin circulate in the systemic blood-stream and are eliminated by the skin, the lungs, the kidneys, and intestinal mucosa.

The exact mode of elimination appears to depend on the individual make-up of the child. In some instances the child will suffer from foul breath, in another from bromhidrosis, in a third from strong-smelling urine, and yet in the fourth from offensive stools. Some indeed may suffer from all of these symptoms in combination. That this view is correct is all the more probable from the fact that we know that the skin is capable of eliminating quite a number of aromatic substances, such as those contained in asafetida, garlic, and onions, which have been consumed as drugs or foods, and absorbed by the intestinal mucosa.

Treatment.

Prophylactic. The prevention of bromhidrosis, like that of its cure, must envisage all the possible etiological factors, such as :

(*i*) The excessive generation of foul-smelling and volatile products of decomposition in the bowel (Intestinal Toxæmia).
(*ii*) The defective de-odorizing functions of the liver.
(*iii*) The decomposition of the secretions of the skin *in situ*.

The various measures available for preventing these possible causes of bromhidrosis will be described in the following paragraphs which are concerned in the cure.

Curative Treatment. The cure of bromhidrosis will be considered under the three headings tabulated above.

(1) *Control of Intestinal Decompositions.* For the fuller particulars of this condition, see Intestinal Toxæmia (page 223), but essentially it demands a strict limitation of protein foods such as meat, fish, game, eggs, and even milk, and the substitution for them of foods of the vegetarian order. Existing defects of gastric or intestinal digestion must be dealt with by the administration of artificial adjuvants to digestion, such as hydrochloric acid, pepsin, papaine, or pancreatic preparations ; and by the correction of any existing dietetic faults. The control of decomposition

processes in the bowel may be attained by the supply of such antiseptics as phenolphthalein, dimol, kerol, or creosote, or by changing the bacterial flora of the bowel by means of one or other of the many varieties of sour milk, or preparations containing lactic acid organisms, such as lactobacilline : or by the administration of absorbents such as kaylene-ol, kaylene, kaolin, or charcoal.

(2) *Treatment of Defective De-odorizing Functions of the Liver.* The most rational cure for exhaustion of the de-odorizing functions of the liver is rest, so that from this point of view the foregoing details for the control of intestinal detoxication apply also indirectly to the treatment of failure of the de-odorizing functions of the liver. The liver, however, may be stimulated to increased activity by such ordinary cholagogues as mercury, salicylic acid, or podophyllin, but the requirement is to take the load off the liver rather than to stimulate it to increased exertions.

(3) *Local Treatment.* This is most important, and consists in the adoption of the same measures as have been referred to in the treatment of hyperhidrosis, namely, the immediate removal of sweat by frequent washing of the parts most affected, especially the axilla, groins, feet and hands, with a dilute solution of permanganate of potash (1 in 1000) or peroxide of hydrogen, 3 vols. per cent, and the application of some astringent lotion such as tannic acid in eau de cologne (1 in 8), which should be allowed to dry *in situ*, followed by thorough dredgering of the skin with a dusting powder consisting of talc, tannoform (1 in 8), and salicylic acid (1 in 20). If thought desirable such dusting powder may be scented with an appropriate perfume.

The Clothing. As in the case of hyperhidrosis, clothing is a factor of importance. This should consist of some cellular material, such as Aerlin, Meshlin (see page 447), or Aertex, and should be frequently changed.

Anhidrosis

This condition is sometimes due to the congenital absence of the sweat glands, a developmental anomaly which may be accompanied by deficiencies in the full complement of the teeth, or other epiblastic hypoplasia, and when this defect exists the anhidrosis is complete, that is to say, the child is incapable of sweating at all. When the condition is acquired, it is only partial, and may be associated with other skin diseases, such for instance as psoriasis in which the glands or their ducts are strangled by fibrotic changes in the *cutis vera*, and thus caused their atrophy.

Treatment. *Prophylactic.* There is no means of preventing the congenital absence of sweat glands, but the effects may be mitigated to some extent by the avoidance of violent exercise, exposure to high temperatures, over-feeding, and other events or circumstances which lead to the excessive production of heat and consequently make demands on the protective reflexes of sweat production. In cases of hypohidrosis, the defective function of sweat production may be stimulated, especially when the failure to perspire is of a temporary nature, by the administration of diaphoretic drugs, such as jaborandi, pilocarpin, sweet spirits of nitre, acetate of ammonium, antipyrin, or other diaphoretic measures such as the giving of hot drinks or Turkish baths which encourage sweating. Vapour baths which are often given to encourage perspiration are not a rational means for securing this end, as by the dampness to which they conduce they deprive the skin of its natural stimulus for sweating, *i.e.* dryness, and thus give a false impression of skin activity.

DISEASES OF THE HAIR AND HAIR FOLLICLES

The list of hair diseases contains among others the following varieties :

Alopecia, hypertrichosis, folliculitis, splitting or brittleness of the hair shaft, and canities or blanching of the hair.

Few of these diseases are of frequent enough occurrence amongst infants or children to require description here, while folliculitis, though fairly common, has been included among the diseases of the sebaceous glands.

Alopecia

(Baldness)

This may be congenital or acquired. The former is exceedingly rare, but in the acquired form it may be due to a number of causes, to ring-worm for instance, or other parasites, and under this heading the account of its treatment is given on page 474. It may be due to roentgen rays, traumatism such as burns, to friction against a pillow, to chemical irritants, or to other morbid states of the scalp, as for instance, seborrhœic dermatitis, pityriasis capitis, or to certain general diseases, such as syphilis, tuberculosis, and diabetes, or to influenza, measles, or scarlet fever.

The varieties of alopecia commonly met with in infants and young children have been classified as follows :

1. A diffuse form with a general falling out or thinning of the hair after fevers or debilitating illnesses.
2. Patches of baldness due to inflammatory lesions of the skin, or to friction.
3. Patches of baldness due to unknown causes (Alopecia areata).

Treatment.

Prophylactic. Prevention depends on the early recognition and treatment of the underlying conditions. That particular form of alopecia known as alopecia areata is a type of baldness which, though common enough after the age of 5, is very rare before that time, and as already stated, its cause is unknown.

Curative. The curative treatment will naturally depend largely on the underlying cause, if this can be discovered, and disturbances of health which are often associated with the defluvium of hair, such as anæmia, indigestion, intestinal toxæmia, and nervous disorders must receive individual attention. There are, however, no drugs for internal administration which can in any way be regarded as specific in the treatment of alopecia. Thyroid preparations, if not exactly specific, are very useful adjuncts in the general treatment, and thyroideum siccum can be given safely to the extent of 1/6th of a grain, thrice daily, in all cases of alopecia.

Local Treatment. The precise nature of the local treatment must be subject to the general condition of the scalp. If any seborrhœa exists, or if there is much scurf or pityriasis capitis, these affections must be treated on the lines suggested under their appropriate headings. Although there is no reason to believe that in the majority of cases alopecia has any parasitic origin, whether bacterial or fungoid, it is just as well to introduce a mild antiseptic into any preparations used for local treatment, since secondary or associated infections are by no means uncommon. The indication for local treatment is to apply drugs with stimulant or irritative properties up to the limit of tolerance. The best drugs for this purpose are glacial acetic acid, cantharides, chrysarobin, resorcin, iodine, and carbolic acid, given singly or in combination. The preparation that I have found most generally applicable is the Lotio Resorcini Pilocarpinæ et Cantharidis (Martindale's Extra Pharmacopæa). This stimulant lotion should be rubbed into the bald patches with a small pledget of cotton-wool. It is not necessary to apply this more than once every other day. In cases of diffuse alopecia combined with seborrhœa or pityriasis in which much less stimulant treatment is required, the following formula will be found useful :

Resorcin	10 gr. (0·6 gm.)
Perchloride of Mercury . . .	5 gr. (0·3 gm.)
Glycerine	1 drachm (3·5 c.c.)

Eau de Cologne to make 1 oz. (30 c.c.).

Brittleness or Splitting of the Hair

(Fragilitas Crinium)

This is a rare condition in infants and young children, and it does not appear to be specific in character, but merely symptomatic of some underlying local or general condition of ill-health. It is specially apt to occur in connection with alopecia, pityriasis, and ring-worm. It is almost certainly not directly connected with any specific microbe.

Treatment. *Prophylactic.* Prevention consists in the general tonic treatment of any underlying malnutritional state, or local affections of the skin. The frequent application of soap and water to the hair not only tends to rot it, but it deprives it of its natural protection of sebaceous secretions, and for this reason should be abjured.

Curative. As in the case of prevention, so in connection with the cure, the underlying conditions both general and local must be appropriately treated. A particularly important detail consists in the avoidance of all forms of rough handling of the hair in brushing, combing, washing, or braiding. Gentle massage of the affected areas certainly helps matters, as also does the occasional rubbing in of the same stimulant embrocation recommended for alopecia on page 516. Small doses of thyroid—*i.e.* thyroideum siccum gr. 1/6th thrice daily are of decisive benefit.

Canities

(Whitening of the Hair; Leucotrichia)

Canities may occur in the form of a diffuse depigmentation of the hair, or it may exist in patchy form. It is very rare in children under 5 years of age, except as a congenital defect. In the latter form it consists of white patches or tufts in the midst of normal hair.

Treatment. Nothing can be done for it in the way of treatment.

Hypertrichosis

(Excessive Growth of Hair)

In infants and young children this condition is always congenital. It may be universal or partial, temporary or permanent. It is particularly liable to occur over the area of so-called hairy

moles, especially in the lumbar or sacral area, overlying the bony hiatus in spina bifida occulta. It is frequently associated with other developmental defects.

Treatment. *Prophylactic.* None.

Curative. Chemical depilatories, or the mechanical extraction of the hairs by tweezers, are contra-indicated, since such measures only strengthen the growth of the hair. The rational treatment consists in the destruction of the hair follicles by electrolysis, or by the surgical removal of the affected area, but the latter method is inapplicable in cases in which the hypertrichosis is widely distributed.

Sclerodermia

This is a very rare disease in infancy or early childhood. It may occasionally occur as a circumscribed hardening of the skin, known as morphœa, or as a diffuse thickening which may be scattered widely over almost the entire surface of the body.

Morphœa

(Circumscribed Sclerodermia)

This affection occurs in oval, rounded, or linear patches, of smooth, ivory-white indurations of the skin. At the edges there is a narrow band of erythema—the so-called "lilac border," which is quite pathognomonic of the disease. This affection may last for years with eventual recovery. The cause is unknown, but the condition generally suggests that it is of toxic origin.

Diffuse Form. This may involve large areas of the skin or almost the entire body. When confined to the hands and fingers it results in a deformity of claw-like appearance, which greatly interferes with the use of the fingers as prehensile organs. This form of the complaint is known as sclerodactylia.

Treatment. *Prophylactic.* As the cause of this disease is unknown, there is no rational means of prevention, but on the assumption that it may be of toxic origin, prophylaxis should consist in the avoidance of all conditions liable to conduce to any form of toxæmia.

Curative. There is no known specific treatment for this condition, but maintenance of bodily temperature, radiant heat, baths, massage, and X-ray treatment; each have their advocates, and should be tried in turn.

For one class of case J. Seller [1] recommends pancreatic pre-

[1] Seller, J., *Brit. Jour. Dermat. and Syph.*, 1934, Dec., p. 523.

parations ; for another, in which the thickened patches are always symmetrical and appear simultaneously on the hands (or feet) and cheeks, and can therefore be distinguished from the former variety, he claims that the best results are obtained from acetylcholine. This choline derivative should be given by intra-muscular injection, $\frac{1}{4}$ of a grain freshly dissolved in 5 minims of sterilized water.

Sclerema

This disease, which has many superficial resemblances to sclerodermia, but is quite distinct from it in that it only affects new-born babies, generally commences about the 3rd or 4th day of life, but may occur later. It consists essentially in the development in the skin of the limbs, trunk, and face, of hard brawny areas of induration, which do not pit on pressure, and are therefore distinguishable from localized areas of œdema. The skin of the penis and scrotum in boys, and of the soles of the feet and palms of the hands, are never affected. The skin is adherent to the subcutaneous areas of hardness, and it is generally of a purplish-red colour. The induration interferes with the free movements of the underlying muscles ; this is particularly noticeable with respect to the muscles of the face, which becomes mask-like and expressionless : sucking is also sometimes interfered with.

The essential pathology of the condition would appear to be connected with the consolidation of the subcutaneous fat, which for some reason or other undergoes certain changes which deprive it of its normal semi-fluid character. It has been thought that sclerema is due to some change in the melting-point of the fat, possibly due to a reduction in the amount of olein which has a low melting-point. The distribution of the sclerosed areas rather supports this view, as the latter occur first in those situations where there is less stearin and a preponderance of olein, namely, in the calves and thighs, and that in these areas the more liquid olein would first be extracted in wasting conditions, and thus leave the less liquid fats (stearin, etc.) in possession of the field. In the hardened areas there are often discoverable fatty crystals, and occasionally free calcium salts. It has more than once suggested itself to my mind that the hardened areas are due to the deposition of insoluble calcium and magnesium soaps, rather than to the consolidation through cold of neutral fats of high melting-point.

The condition generally runs a fatal course, but cases of recovery are on record. Children suffering from this condition generally

have a low temperature, and many evidences which suggest a condition of sepsis.

Treatment. *Prophylactic.* Beyond maintaining the bodily temperature of new-born infants by electric blankets, hot-water bottles, or other means, little can be done in the way of prevention.

Curative. There is no definite line of treatment for these cases that can be regarded as specific or rational. It is possible however that the avoidance of fats in the food, which contain a preponderance of stearin and a minimum of olein, may have some influence on the course of the disease. The administration of thyroid is undoubtedly of value in maintaining the bodily temperature, which in the case of this disease is almost invariably low. The use of the electric blanket, or hot-water bottle is also indicated.

NEOPLASMS OF THE SKIN

Corns

Corns in young children are not very common, but they do occasionally occur, and as in the case of older individuals, they may be either soft or hard. The former generally develop between the toes where dampness has a macerating effect, while the latter occur on exposed surfaces subject to intermittent pressure, such as on the outside of the small toes, or on the ball of the big toe.

A bunion, properly speaking, is a bursa, which forms between some hard superficial callosity and a joint or bony prominence beneath.

Treatment.

Prophylactic. Prevention consists in the provision of properly fitting footgear, and the avoidance as far as possible of all sources of intermittent friction.

Curative. The treatment of hard corns consists in paring down the keratinized epithelium to the level of the surrounding skin with a sharp cornknife, and then painting the surface with a saturated solution of salicylic acid in collodion. The application should be repeated daily until at the end of a week or so the hard core drops out. During this process a properly fitting corn plaster should be applied to give relief to the pressure on the corn itself, and to maintain the collodion in position. The cutting and adjustment of corn plasters appears to be a lost art, but it is one which repays the time and attention bestowed upon it.

Soft corns are more troublesome to deal with. The essential element in their cure consists in converting them into the hard variety, which can then be treated in the way described above.

The toes between which the soft corn is situated should be kept separated by cotton-wool, and the intervening space painted every day with tannic acid in alcohol (1 in 8), which should be allowed to dry, and subsequently dusted with tannoform combined with 8 parts of talc powder.

When the corn has become dry and indurated by this treatment, it should be painted with salicylic acid and collodion in the manner described above. In the course of a week or 10 days the hard central core usually drops out.

Plantar Corns. The treatment of corns on the sole of the foot, especially those over the ball of the big toe which give a great deal of trouble, are so effectually treated by radium or X-rays that no other method of treatment needs description. A half-pastille dose is generally sufficient and need not be repeated.

Callosities

These consist in the hypertrophy of the horny layers of skin in parts which are exposed to constant or severe friction, such as the heels or the tips of the fingers. They are comparatively rare in children under 5 years of age. These callosities are protective in character and differ from corns in that they possess no central core or vascular papilla.

Treatment. *Prophylactic.* Prevention consists in the removal of the cause of friction.

Curative. This consists in painting the keratinized skin with salicylic acid in collodion, and subsequently rubbing down the callosity itself to the level of the surrounding skin with pumice-stone. X-rays or radium treatment is as satisfactory as in the case of plantar corns.

Bunions

Bunions are more difficult to treat. When once a bunion has formed, it can only be eradicated by surgical means, but it can be kept free from inflammation and pain if pressure on it is relieved by a suitably fashioned corn plaster.

Warts

(Verruca vulgaris)

Although warts may assume many different forms in children, the common variety is the so-called " plane " wart, which occurs for the most part on the face, hands, and forearms, as a small rounded and hard papilloma of the same colour as the surrounding skin. These warts are auto-inoculable, and can be transmitted

from individual to individual. The nature of the infective organism is still unknown.

Treatment.

Prophylactic. This consists in the avoidance of contact with infected children, and in the protection of existing lesions from abrasions by scratching, cutting, etc., which cause bleeding, and may lead to auto-inoculation.

Curative. The general treatment is unimportant, but salts of magnesium, calcium, and mercury, taken internally, have been credited with some degree of specific action, which in my own personal experience is not borne out in practice.

Local. A great many different methods have been adopted for the treatment of these growths, as for instance, freezing with carbon dioxide snow, cauterizing, X-rays, electrolysis, and surgical removal. The only lines of treatment that require consideration here are the employment of X-rays, radium, or caustics. The choice of method depends very largely on the number of growths. If they are very numerous the employment of either X-rays or radium is contra-indicated, although both of these methods are useful for a few individual warts of fairly moderate size. For multiple growths the application of a salicylic acid plaster gives the best prospect of a cure—that is to say, if the plaster can be left in position for a sufficiently long time. If the number of growths is not too great, the simplest and most effective method is to touch each individual wart with the end of a wooden probe which has been dipped in fuming nitric acid. Care must be taken that the acid does not overflow on to the surrounding healthy skin, since if it does it not only causes pain, but it may lead to scarring. Two or three days after the first application of the acid, the desiccated wart should be carefully pared off with a sharp knife, and the stump again treated with the acid. As a rule the process of painting and paring must be repeated several times before the papilloma is completely removed.

Molluscum Contagiosum

This is a somewhat rare condition which occasionally attacks quite young children. The growths appear as minute rounded excrescences on the epidermis, which subsequently become dimpled and flattened with minute openings in their centres. The lesions grow slowly, and may eventually attain the size of a filbert, and become pedunculated. In the later stages a white creamy liquid can be expressed. The lesions can occur on any part of the skin, with the exception of the hands and feet. As its name

implies, it is contagious, and auto-inoculable. The virus is unknown, but it is definitely a filter-passer, and has a particularly long incubation period, sometimes exceeding three months.

Treatment. *Prophylactic.* Owing to the contagiousness of the disease precautions must be taken to prevent transmission from an affected to a healthy child by means of towels, clothes, dressings, bedding, or direct contact. Several epidemics of quite an extensive character have occurred in institutions, such as schools, hospitals, and reformatories.

Curative. The cure consists essentially in the surgical removal of the growth. Small mollusca can sometimes be cured by clearing out the contents by squeezing, but as a rule they require removal by snipping off with scissors, or by means of a Paquelin's cautery. As these processes are distinctly painful a local or general anæsthetic should be employed. After removal of the tumour its base should be treated with some antiseptic dressing, such as dilute ammoniated mercury ointment, to prevent auto-inoculation.

Nævi

Although according to modern nomenclature the term nævus is applied to a great number of different cutaneous anomalies of the skin, circumscribed in distribution and embryonic in origin, such as the different varieties of vascular angiomata, lymphangiomata, moles, and fibromatous nævi, in this account of the treatment of these defects it will be sufficient to take a limited number of types, such as the vascular, lymphangiomatous and fibromatous.

Vascular Nævi.

There are two forms of vascular nævi :

1. The capillary, which is flat and not raised above the surface of the skin.
2. The cavernous type, which is not only raised, but often papillomatous.

Capillary Nævi. This type represents the form of growth which is often called a " Port Wine stain." It may occur in any situation of the body, but is most common at the central and lower part of the occipital region in infants. More than 25 per cent of all infants show a " Port Wine staining " in this area.

Treatment.

Prophylactic. None.

Curative. The choice of treatment lies between radium, X-rays, refrigeration, electrolysis, and scarification. Mild cases require no treatment.

Radium : The cases most suitable for radium treatment are those which are quite superficial, and in which there is no infiltration of the subcutaneous tissues, and in which there is complete blanching under pressure with a cover-glass. Radium treatment, however, requires considerable care and should only be carried out by an expert.

X-rays : This method is also somewhat difficult and risky, as the cure if effected is liable to be succeeded by scar formation.

Refrigeration : This is much the best method of treatment for the majority of cases of moderate dimensions. It is carried out by means of applying carbon dioxide snow to the growth. The application is followed by blistering which leads to a mild fibrosis and obliteration of the vessels. The treatment should only be carried out by an expert, as success depends on the degree of pressure applied, and on the duration of the exposure, both of which have to be co-ordinated to the particular requirements of the case.

Electrolysis : This is a useful method of treating the so-called " Spider Nævi," but is not as a rule applicable to angiomata of greater size.

Scarification : This method depends on the formation of a scar, after the application of some caustic substance such as ethylate of sodium, cantharides, or croton oil, or by actual cautery. It also includes the cicatrization which follows ordinary vaccine inoculation.

Most of these methods are inadvisable owing to the great risk of disfiguring through scar formation, while vaccination is only suitable in special cases when the nævus is situated in some part of the body where scar formation is of no importance.

Cavernous Nævi (*Strawberry Birthmark* ; *Cavernous Angiomata*). In infants these growths vary in size from a split pea to that of a man's hand. They may be flat, rounded, nodular, or pedunculated. The seats of election are the face and scalp, but they may involve any part of the skin. Except from the point of view of disfigurement, these lesions are harmless, and the risk of hæmorrhage from abrasions is small ; they are more liable to grow smaller and disappear spontaneously in the course of a few years, than to grow larger, but their progress should be watched carefully, since if there is any tendency to enlargement they should be surgically removed.

Treatment.

Prophylactic. None.

Curative. These cavernous or raised hæmangiomata can be

treated in the same way as capillary nævi, that is to say, by radium, X-rays, refrigeration, cauterization, electrolysis, or excision, but the choice of method is still more important and difficult to decide. Provided the tumours are not larger than 1 or 1½ inches in diameter, the choice generally lies between surgical removal, refrigeration, or radium treatment. The so-called giant vascular nævi are difficult to treat, since there is danger of hæmorrhage at the time of operation, or unsightly scarring afterwards.

Excision : This is a satisfactory means of removing nævi which are too large for freezing or radium treatment. The more completely they are encapsuled the easier the operation. If the tumour is not too large and the healthy edges of the skin can be brought together by sutures, very little scarring or deformity will result. For larger growths, plastic operations with grafting of flaps of healthy skin can give from the æsthetic point of view most excellent results.

Refrigeration : Freezing by means of blocks of carbonic acid snow applied for 10 to 20 seconds with a medium amount of pressure, gives good results. The blister which appears in the course of a few hours should be allowed to dry up without evacuation of its contents. As a rule more than one application is necessary to eradicate the tumour, and if the latter is of large size the operation may have to be performed in several stages.

Radium : Treatment by this method is slow and expensive, but it is painless and can be carried out while the infant is asleep ; scarring is inevitable by whatever manner cavernous nævi are treated, so that the danger of disfigurement by the radium is no contra-indication to its application, as in the case of simple nævi.

Lymphatic Nævi.

Lymphatic nævi can exist in the form of dilatations of lymphatic vessels (lymphangiectasis), or new growths (lymphangiomata), but in infants and young children this type of nævus is usually present in circumscribed form.

Circumscribed Lymphangiomata. These generally consist of a circumscribed and irregular cluster of translucent vesicles which elevate the skin and present a " frog spawn-like " appearance. They may occur on any part of the cutaneous surface, but most frequently on the neck and lateral aspects of the trunk.

Treatment. *Prophylactic.* None.

Curative. Excision by surgical means.

Moles

Moles differ from nævi in that they are non-vascular growths and depend for their colour on the presence of a pigment (Melanin) in the cells of the basal layer, in the prickle cells, or very occasionally in the corium. The growth may be raised or level with the surface of the skin.

Treatment.

Prophylactic. None.

Curative. Since moles tend to increase in size, and occasionally in later life to become the seat of malignant changes, it is advisable to remove them at an early date. As in the case of nævi, they may be treated by refrigeration, electrolysis, caustics, or by surgical means. Neither X-rays nor radium treatment is advisable, owing to the scarring which results from the violent reaction necessitated for eradication. Neither electrolysis nor caustics give very good results.

Refrigeration: This is the method of election for moles of average size. Carbonic acid snow should be applied with moderate pressure for about 40 seconds, and the blister which develops in a few hours should be incised and treated antiseptically. It is generally necessary to repeat the operation more than once.

Fibromatous Nævi

These growths are comparatively rare in infants and young children, but the closely allied conditions of molluscum contagiosum and von Recklinghausen's disease are occasionally met with. The treatment of the two latter however has already been described under their appropriate headings (see pages 523 and 547) and need not be repeated here. The treatment for other forms of fibromatous nævi is surgical removal.

DISEASES OF THE NAILS

The nails are subject to a great number of different pathological affections which take the form of hypertrophies, atrophies, and dystrophies, dependent on congenital conditions which are not understood, or upon general or local conditions which are acquired, and for which the causes are generally apparent.

The common causes of the acquired forms of the disease are irritation by physical means, such as trauma or X-rays, by chemical substances used in the treatment of some skin disease, and various forms of parasites. In addition, syphilis, as well

as circulatory and nervous disturbances are also responsible for a few cases.

The only forms for the treatment of which individual description is needed are those which are due to infection, or are secondary to certain skin diseases, such as eczema, psoriasis, and alopecia areata.

Infective Onychia

Infective inflammation of the nails may result from pyogenic organisms such as the streptococcus pyogenes, staphylococcus pyogenes aureus, from fungi such as those concerned in ring-worm, favus, or from the acarus scabei. In pyogenic infections of the nails the inflammation may be confined to the nail itself and the nail-bed, when the condition is called "Onychia," without any special epithet. When the surrounding tissues are involved the condition is known as peri-onychia. When, however, the inflammation involves most of the deep tissues of the terminal phalanx the condition is called paronychia, panaritium, or whitlow. A rare and interesting form of onychia in infants is one which is due to a Monilia infection, which develops in young infants who are suffering from a monilia infection of the mouth, namely, thrush (monilia albicans). Infections of the skin and mucous surfaces with pathogenic forms of monilia are beginning to arouse considerable interest in mycological circles. They can only be diagnosed with certainty by microscopical examination of the surface exudates, or by cultivation on suitable media. As mentioned elsewhere in the account of treatment of thrush (see page 171), Monsol in weak dilution (about 1 in 200) seems to be almost specific.

Treatment. *Prophylactic.* None.

Curative. In all cases of acute onychia due to infective causes the treatment is essentially that of the primary trouble. The local treatment, however, consists in the application of antiseptic fomentations in order to clear up the discharges, and in the touching of exuberant granulations with nitrate of silver. Avulsion of the nail is rarely necessary, but the decision as to when a whitlow is to be incised always presents difficulties, and should be postponed until there is definite fluctuation, when a bold incision should be made parallel with the border of the nail.

Onychia due to Skin Diseases.

The common forms of onychia due to these causes are those associated with eczema, psoriasis, and alopecia areata.

Treatment. *Prophylactic.* This consists in the early and

energetic treatment of any primary skin trouble in the neighbourhood of the nails, before it involves these structures.

Curative. This consists in the treatment of the primary complaint, and in the application of boracic acid fomentations, followed by a dressing of zinc paste.

CHAPTER XV

DISEASES OF THE NERVOUS SYSTEM

Hydrocephalus

(Water on the Brain)

Hydrocephalus represents an accumulation of the cerebro-spinal fluid within the ventricular system and arachnoid spaces. It is dependent on a disturbance of the normal relationship between the amount of fluid secreted by the choroid plexuses and that which is absorbed in the arachnoid spaces. That is to say, it may be due to an increase in the quantity of fluid secreted, or a decrease in the quantity absorbed. The fluid is mostly secreted by the choroid plexuses of the lateral ventricles, but in lesser degree also by the corresponding vascular fringes in the 3rd and 4th ventricles. Under normal conditions the quantity of fluid secreted is enormous : it is said to be renewed four or five times in the 24 hours. It is absorbed through the arachnoid spaces which are widely distributed over the surface of the brain, and to a lesser extent over the surface of the spinal cord. Any obstruction to the normal flow of cerebro-spinal fluid through the lateral ventricles, through the foramina of Monro, into the 3rd ventricle, and thence by the aqueduct of Sylvius into the 4th ventricle, and again onwards through the 4th ventricle into the cisterna magna, through the foramina of Magendie and Luschka, will occasion a distension of the ventricular system behind the point where the block occurs, and in consequence, owing to pressure, a thinning out of the cerebral cortex, and a condition of hydrocephalus of the non-communicating or obstructive type.

The obstruction can be caused by a matting with fibrous adhesions of the roof of the 4th ventricle, or between the free edge of the tentorium and the brain-stem, bringing about occlusion of the foramina of Magendie and Luschka, but it can also be caused by the pressure of tumours, or by congenital malformations, which in their respective manners interfere with the circulation of the cerebro-spinal fluid at any point between the lateral ventricles and the cisterna magna. The most common form of obstruction is

the development of adhesions near the cisterna magna, or roof of the 4th ventricle, the result of meningitis. Although the cause of these adhesions is usually meningococcic meningitis, occurring after birth, it is sometimes due to a meningitis which developes before birth, or shortly afterwards in so mild a degree that it is not recognized as such but gives rise to the idiopathic type of case—so called because there is no obvious cause. Congenital atresia of the foramina of Monro, or congenital absence of the aqueduct of Sylvius may also give rise to obstructive forms of hydrocephalus.

Hydrocephalus of the non-obstructive or communicating type is due to the defective absorption of the cerebro-spinal fluid in the arachnoid spaces, which for various reasons may remain undeveloped, or become obliterated. From the point of view of treatment and prognosis there is a fundamental distinction between the two types of hydrocephalus—that is to say, between those which are due to actual blockage of the ventricular circulation, and those which are due to obliteration of the absorbing surfaces, because a cure is practically impossible in the first class of case, while in the second, under suitable conditions, quite a considerable proportion of recoveries can take place.

In dealing with a case of hydrocephalus in an infant or young child, before commencing treatment, or hazarding a prognosis, the first step should be to ascertain whether it is one of the communicating or non-communicating type. This question can be settled in one of the following ways :

(1) By injecting ½ c.c. of neutral and sterile phenol-sulphonaphthalein into one of the lateral ventricles through the anterior fontanelle, if this is still open, or otherwise by a small trephine opening. If the foramina of Monro are open the dye passes rapidly into the lateral ventricle on the opposite side, and can be recognized by tapping and drawing off some of its contained fluid. If the intra-ventricular system is pervious throughout the entire extent the dye can be recovered within half an hour of the time of its injection by means of lumbar puncture. If, however, after an interval of three-quarters of an hour no dye can be recovered by lumbar puncture, the case is almost certainly one of the non-communicating type.

(2) The second method is much simpler and in my experience is quite reliable. It consists in performing lumbar puncture without any preliminary injection of dye into the lateral ventricle. If the cerebro-spinal fluid flows freely and as much as 10 c.c. or more can be withdrawn, it is extremely improbable that the case is one of the non-communicating type. The correctness of the

diagnosis can be corroborated by repeating the puncture next day. If in the interim sufficient fluid has accumulated to allow of a second withdrawal of a similar amount of fluid or the fluid runs quite freely, it is almost certain that the case is one of the communicating type.

If no dye can be recovered by the first method, or if the evidence of the second method points to the hydrocephalus being of the non-communicating type, the block must be either in the roof of the 4th ventricle, in the aqueduct of Sylvius, in the 3rd ventricle, or in the foramina of Monro.

To determine the exact site of the obstruction, ventriculography can be performed—that is to say, air can be injected into the lateral ventricles (see page 726), and its shadow determined by X-ray examination. There is not sufficient statistical evidence to show the relative numbers of the communicating and non-communicating types—that is to say, the relative proportions of those which are likely to receive benefit by treatment and those which are not. My own personal experience has been that exclusive of the large number of cases which are due to the secondary effects of recognizable meningococcic infection, and which consequently are almost beyond cure, about one-third of the remaining cases, most of which are definitely congenital in character, are of the communicating type, and as such are largely amenable to treatment.

Treatment.

Prophylactic. Little can be done in the way of prevention, except to ensure that syphilis shall not contribute its small quota of cases, by seeing that the ante-natal treatment of the mother is undertaken at a sufficiently early period in the pregnancy to save the child, or by immediate and energetic treatment of the infant after birth as soon as the diagnosis of syphilis has been made.

All cases of meningococcic meningitis are potential sources of hydrocephalus, and consequently this danger should be recognized, and every effort made to prevent the formation of adhesions by a vigorous pursuit of the anti-meningococcic serum treatment, as well as by the employment of frequent cisterno-lumbar irrigations with sterile normal saline. This treatment definitely lessens the danger.

Curative Treatment. One would conclude from the pessimistic views usually held and expressed in pædiatric circles that the treatment of cases of hydrocephalus was almost always a failure.

This has not been my experience with regard to carefully selected cases of the communicating type, when resort has been made to the dehydration method of treatment, presently to be described.

As regards treatment of the obstructive or non-communicating type, I am even more pessimistic than most of my colleagues, and place very small reliance on surgical procedures.

Non-Communicating or Obstructive Types.

A number of very ingenious operations have been devised, or suggested, for the effective drainage of the distended ventricles. If the block involves the cisterna magna, this can be dealt with surgically by the sub-tentorial route, and the adhesions removed. If there is atresia of the aqueduct of Sylvius, attempts can be made to dilate its lumen with a catheter, approaching the position also by the sub-tentorial route. If the block is proved by ventriculographic methods to be above the aqueduct of Sylvius the floor of the 3rd ventricle can be removed, and a direct communication made with the interpeduncular sub-arachnoid spaces. Another somewhat heroic procedure is to dissect out the choroid plexuses from their attachments in the lateral ventricles, but this, along with such methods as the tying of the internal carotid artery, or attempting to establish communication between the lateral ventricles and some distal absorption area such as the scalp or retroperitoneal spaces, is merely a policy of despair, and in my view, neither practical nor justifiable.

On the other hand, a good deal can be done to mitigate the miseries of the great degrees of cranial expansion often met with, if such cases are treated by the dehydration method, before the ventricles have assumed any serious degree of distension.

I had under my care at The Infants Hospital, a very rapidly developing case of obstructive hydrocephalus, in an infant 6 months old. The circumference of the head had by that age reached 23 inches. From the time that the dehydration treatment was started, until the time of death a year later, the head remained exactly the same size. I was fortunate enough to obtain permission for a post-mortem examination. This confirmed the diagnosis made *intra vitam*, that the obstruction was between the 3rd and 4th ventricles. The aqueductus Sylvii was entirely absent, and represented by a solid rod of connective tissue with no lumen whatsoever. This child did not die from the direct results of the hydrocephalus, but from an intercurrent infection. During the whole time of her stay in hospital, and of subsequent convalescence, she seemed perfectly happy and contented, although there was considerable papillœdema, nystagmus, and mental defect. It is impossible to say to what extent the expansion of

the skull would have proceeded had not dehydration treatment been instituted, nor is it possible to say how long the child would have lived.

In all cases the treatment of hydrocephalus should include measures for dealing with the concomitant cranio-tabes. This is best carried out by intensive vitamin D and calcium therapeusis. By this means closure of the fontanelle and sutures can be accelerated, and further expansion of the head hindered.

Author's Dehydration Method of Treatment.[1]

The earlier the date at which treatment commences, the better the result. If the stage of papillœdema, nystagmus, or optic atrophy has been reached, too much damage has already been inflicted on the brain substance by the pressure to allow of a complete recovery. All the successful cases I have had have been those in which the treatment has been commenced before the age of 6 months. Most of them have been under 3 months, and in no case has the circumference of the head been more than 22 inches at the time treatment was commenced. All of the cases have been of the communicating type, as proved by lumbar puncture, or dye test described above. The method is as follows :

The intake of fluid is restricted to a maximum of 18 oz. in the 24 hours for infants over 6 months of age. For younger infants the quantity is further reduced—at 3 months I generally allow a maximum of 15 oz. It is quite possible to keep within these limits even in the case of breast-fed infants, by expression of the fore-milk, and by allowing the infant to obtain the strippings only. Every feed must be checked by the " Test Feed," and the total amount taken at all the feeds should be calculated at the end of the day.

The required Calorie allowance is secured by the addition of condensed milk, either sweetened or unsweetened, according to the requirements.

In the case of bottle-fed babies, the control is much easier. Each feed should be made up to the required volume, balance, and Calorie value by the dilution of humanized dried milk. If preferred, condensed milk with the addition of Vitoleum Cream may be substituted for the dried powder, but whatever method of feeding is adopted it should fulfil the requirements of balance and Calorie value. In the case of bottle-fed infants I always

[1] A short preliminary account of this method was given at the Annual Meeting of the British Pædiatric Association in 1931, and a briefer report still was published in the " Archives of Disease in Children," 1931, vol. vi, p. 258, but no full account of the method has heretofore been published. Nineteen suitable cases have been successfully treated and cured.

insist on a daily allowance of 4 oz. of Bone and Vegetable Broth, made in accordance with the formula (page 708). This replaces an equivalent amount of water in making up the bottles.

In order to promote the dehydration process, it is desirable to encourage the loss of water by the kidneys, by the giving of some suitable diuretic, such as diuretin, and the activity of the skin by warm clothing, suitable room temperature, and heliotherapy. Loss of water by the bowel may be secured by mild aperient treatment.

In addition to these procedures, I find that a small dose of iodine promotes the absorption in the arachnoid spaces. For the cranio-tabes and to hasten the closure of the fontanelle and

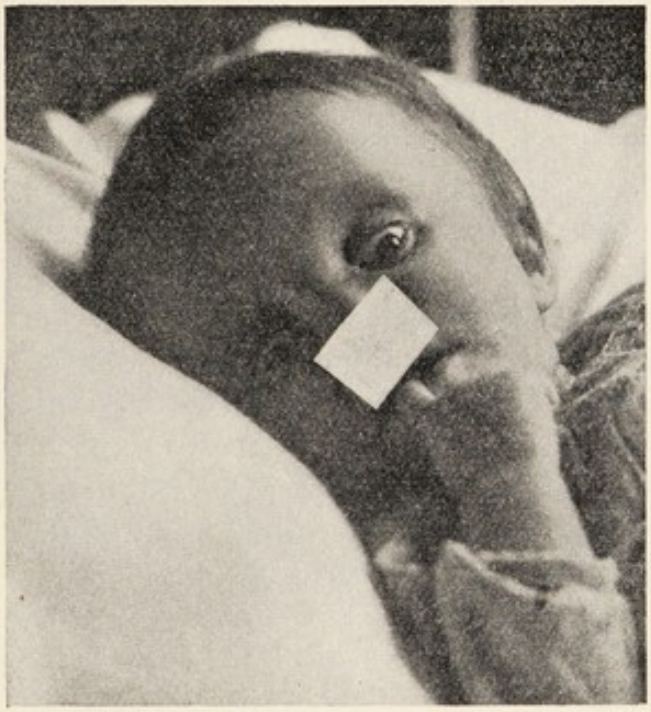


FIG. 21.—Hydrocephalus. Boy, 5 months, at commencement of dehydration treatment.

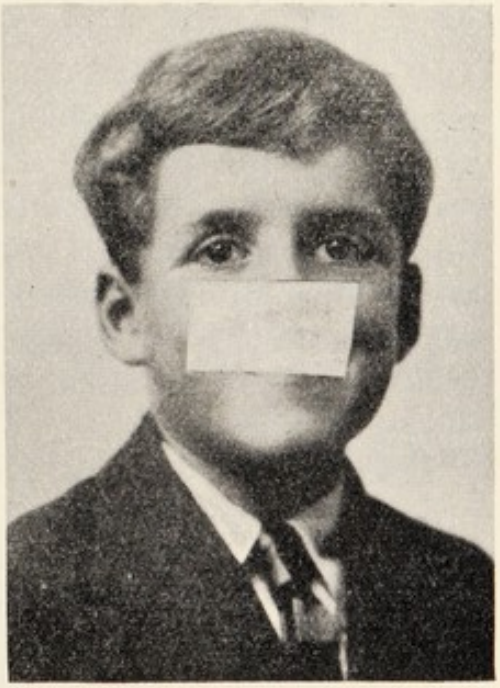


FIG. 22. — Hydrocephalus. Same boy aged 10 years, after treatment, between 5 and 17 months.

sutures, I advise large doses of vitamin D, even at the risk of producing a condition of hyper-vitaminosis. Calcium can be provided in the form of calcium lactate. The Danish preparation Greenosan (page 707) to the extent of 2 tablets daily is a convenient form of administering the required vitamins and mineral elements.

If the above details are strictly observed, the circumference of the head will almost certainly cease to increase in size, indeed, I have frequently known it become smaller, and the width of the sutures grow less. The fontanelle often becomes considerably cupped in the process of dehydration. In one case it became so sunken that the practitioner in charge telephoned to know whether he should do anything to prevent collapse. I have never known

any harmful consequences result from such cupping, or from dehydration by these artificial means. The illustrations (Figs. 21 and 22) show the condition before and after treatment in a very successful case in which complete cure resulted, without leaving any untoward sequelæ.

Syringomyelia

This is a very rare condition in young children—I do not think any genuine case has been recorded in a baby under 1 year of age. It consists in an enlargement of the central canal of the cord, due to a circumscribed gliosis of part or whole of the canal wall, which subsequently undergoes degenerative changes and leads to ballooning of the central cavity. The condition is characterized by a dissociated anæsthesia, with insensibility to painful and thermic impressions. There are also trophic changes. I recently had a case which appeared post-mortem to be one of syringomyelia, that is to say, the central canal in the cervical area was enormously dilated, but there was no gliosis which by its degenerative changes could have accounted for dilatation, in fact no cause of any kind could be discovered for the dilatation of the central canal. The symptoms were those of an ordinary spastic diplegia, or Little's disease, for which the case was mistaken during life.

Treatment. There is no known treatment for this condition prophylactic or curative. The child must be protected from injuries which are liable to arise due to the anæsthesia and trophic disturbances.

Spina Bifida

Although this condition is closely allied to hydrocephalus, and at times may be associated with it, the description of it and its treatment has been included in the Section which deals with Diseases of Bone (page 591).

Encephalitis

(Encephalitis Lethargica : Sleepy Sickness)

I find myself in the same difficulty in fitting the many known varieties of encephalitis into my general scheme of classification, as I do in the case of certain other infective diseases of the central nervous system, such as tetanus, cerebro-spinal fever, and tuberculous meningitis. The difficulty is to decide whether they should be included under diseases of the central nervous system, or among the infectious diseases. In choosing the latter alternative there are almost as many arguments for as against,

and I shall therefore refer briefly to certain forms of encephalitis in this section, although they have already been included in Chapter XIII.

Encephalitis is an inflammation of the grey matter of the brain, basal ganglia, or brain-stem. It is however usually followed by some degeneration of the neurones, and a reduction in the number of nerve cells in the grey matter in the above situations. Encephalitis, which may occur in a great many different forms, is generally assumed to be that particular epidemic form known as encephalitis lethargica, unless otherwise stated. Encephalitis can however occur as a complication or sequela of any of the specific fevers, such as influenza, measles, smallpox, whooping-cough, or in vaccinia, etc., and although the course which these several varieties of encephalitis usually run, and the characteristic nature of the resulting pathological lesion may differ, as also may the prognosis, the treatment is practically the same in all cases, and equally unsatisfactory.

Treatment.

Prophylactic. As far as preventive measures are concerned, it may be summed up by saying that prophylaxis consists in the avoidance of exposure to infection. The number of cases of post-vaccinal encephalo-myelitis is so small, namely, not more than 1 in 33,000 vaccinations, that it need not be regarded as an argument against resort to this valuable prophylactic measure.

Although it is highly probable that convalescent serum, if injected immediately after infection or during the early days of incubation, would be effective in preventing or mitigating the disease, at the present time we have no practical experience to guide us.

Curative. J. B. Neal and D. A. Bentley [1] give a list of the various expedients which have been tried in cases of epidemic encephalitis, which include serums, vaccines, drugs, and the artificial production of febrile reactions. None of them however merits confidence, though it is possible that if convalescent serum could be obtained from a suitable donor and injected early enough, it might have a material influence on the course of the disease, but it is extremely doubtful whether it would be of any use as a curative measure when once the disease has become fully established, or after degenerative changes in the nerve cells have begun. Everything points to the fact that our therapeutic efforts should be confined to palliative means, such as lumbar puncture to reduce the cerebro-spinal tension, and sedatives to relieve

[1] *Arch. Neurol. and Psychiat.*, 1932, vol. xxviii, p. 897.

convulsive symptoms. My own experiences in the treatment of the disease are almost exclusively confined to the use of hexamine. Some few years ago a veterinary surgeon told me that he had treated an epidemic of encephalitis occurring in a pack of fox-hounds by giving huge doses of hexamine, and had compared the results with control cases which had not received the drug; he was convinced of the efficacy of the method. Since then I have applied the same treatment in the case of children with favourable results. The dose must be heroic. I have been in the habit of giving not less than 10 grains three times a day to infants 1 year of age, and larger doses in proportion to older children.

Sequelæ. The treatment of the innumerable mental and physical disabilities which follow an attack of encephalitis, includes physio-therapy, hydro-therapy, electro-therapy, massage, remedial exercises, occupational therapy, and other measures too numerous to mention, and requiring the advice and guidance of an expert used to the treatment of these cases.

Meningitis

Meningitis may take the form of inflammation of the pia-arachnoid (leptomeningitis), or of the dura (pachymeningitis). It may be due to the tubercle bacillus, meningococcus, pneumococcus, staphylococcus, streptococcus, the bacillus coli, the influenzal bacillus, and certain other organisms connected with the infective fevers, such as those of typhoid, mumps, etc. From the point of view of prognosis and treatment, it is important to be able to distinguish the precise nature of the infection, which must naturally be treated on specific lines.

The diagnosis is in most cases readily and accurately made by means of laboratory examination of the cerebro-spinal fluid.

Tuberculous Meningitis.

About 32 per cent of all cases of meningitis in children are of the tuberculous variety. The differential diagnosis lies chiefly between teething, intestinal colic, encephalitis, poliomyelitis, pyelitis, pneumonia, uræmia, and other varieties of meningitis. The type can easily be decided by examination of the cerebro-spinal fluid, which in the case of tuberculous meningitis is colourless, with cobweb-like coagulum, and contains increased protein (0·05–0·25 per cent), decreased chlorides, and decreased glucose. The cell count is 100–300 per c.c. mainly lymphocytes: tubercle bacilli present. Tubercle bacilli can be found in more than 90 per cent of cases of definite tuberculous meningitis, if a careful search be made for them by the following method. Half of the fluid

withdrawn should be set aside in a clean, polished, and sterile test-tube at room temperature for 24 hours. At the end of this time the characteristic cobweb-like cloud of filaments is seen pervading the whole of the fluid. The fluid containing this clot is poured gently on to a perfectly clean slide, on which the film is spread out. It is then dried, fixed, and stained, by the Ziehl-Neelson method. If the search is pursued with sufficient diligence, tubercle bacilli will practically always be found if the case is one of tuberculous meningitis.

The prognosis is to all intents and purposes quite hopeless, although a few not very well-authenticated cases of recovery have been reported. I had one case, which was diagnosed as tuberculous meningitis on the strength of the symptoms, and the presence of the tubercle bacillus in the cerebro-spinal fluid. This case appeared to recover for a time completely, but 18 months later he was admitted again into hospital suffering from the same symptoms, from which he died a few weeks later. On autopsy there was found to be a large tuberculous tumour the size of a small egg in the region of the tentorium, which was more or less encapsuled and shut off by fibrous adhesions, but from which no doubt a small number of tubercle bacilli escaped and were detected on examination in the cerebro-spinal fluid, and thus afforded ground for a diagnosis of tuberculous meningitis. Possibly if this case had survived a little longer, or had been lost sight of, it would have figured among the reported cases of recovery.

Treatment. *Prophylactic.* Every case of tuberculosis in infants and children is a potential case of tuberculous meningitis, which is the most frequent cause of death in fatal cases of tuberculosis at these ages, but, as previously stated on page 157, a great deal can be done to protect infants exposed to a tuberculous environment from becoming infected, as for instance, by commonsense efforts, and artificial immunization (page 158). Moreover, by the intensive creosote treatment combined with good feeding, and appropriate hygienic conditions, a cure of the disease in its early stages can often be effected, and hence the dangers of meningeal involvement considerably lessened.

Curative. There is no known means of influencing the fatal course of tuberculous meningitis. All that can be done is to mitigate the actual suffering of those affected by means of narcotic or anodyne drugs. When once a diagnosis of tuberculous meningitis has been definitely arrived at by an examination of the cerebro-spinal fluid, efforts to prolong life are futile, and the child should be kept in a permanent condition of semi-consciousness and

freedom from pain by large doses of one or other of the barbituric drugs. I prefer these to either morphia or heroin which are usually employed. I have found veronal sodium (Bayer) 1–3 gr. admirably suited to this purpose, and this dose should be repeated sufficiently often to keep the child in a somnolent condition. Dial (Ciba) $\frac{1}{4}$ to $\frac{1}{2}$ tablet answers the same purpose.

Meningococcal Meningitis (*Cerebro-Spinal Fever*).

This form of meningitis is, next to the tuberculous variety, most common. It supplies about 30 per cent of all cases of meningitis. The diagnosis can be clinched by examination of the cerebro-spinal fluid, which is turbid or purulent with increased protein, and diminished glucose. Cell count enormously increased —1,000 to 2,000 per c.c. with excess of polymorphs, and presence of meningococcus in stained smears and in culture. For further particulars see page 426.

Streptococcic Meningitis.

This form of meningitis is usually secondary to otitis media, mastoid infection, septic omphalitis, or generalized septicæmia.

Treatment. *Prophylactic.* Preventive treatment consists in dealing with the primary foci of infection by surgical means and specific sera, before the infection has an opportunity of becoming generalized.

Curative. Polyvalent anti-streptococcal serum to the extent of 5–10 c.c. should be introduced by the cisternal route. It may be mixed with 6–8 c.c. of fresh human serum (complement). The injection should be repeated at intervals of 2 days if the treatment affords satisfactory results. Streptococcal anti-toxin (scarletinal) has been used for the same purpose, and has been favourably reported on; so also has Prontosil (see page 699). Another method of treatment and a last resource is to inject 2 c.c. of Pregl's concentrated iodine solution (page 718) into each common carotid; this is followed by cisternal drainage. The injection may be repeated every day for 4 days.

Staphylococcus Meningitis.

This very serious form of meningitis is rarely influenced by treatment. It generally pursues its course to a fatal termination.

Treatment. *Prophylactic.* All sources of primary infection, such as osteomyelitis, or scalp wounds in new-born infants, must be treated by surgical and antiseptic means.

Curative. If thought desirable the case may be treated by staphylococcic toxoid (P. D. & Co.), and the meningitis itself by an injection of Pregl's concentrated iodine solution into the two internal carotids, as described under streptococcus meningitis, or

0·5 per cent neutral acriflavine may be substituted for it. The intra-muscular injection of prontosil is worth trying (see page 700).

Pneumococcus Meningitis. This is a desperate condition, and as such justifies heroic treatment.

Treatment. *Prophylactic.* As this type of meningitis is usually secondary to broncho-pneumonia, or empyæmia, the energetic treatment of the primary condition constitutes the main prophylactic measure.

Curative. For the curative treatment of this almost universally fatal condition, the intra-arterial injection of certain antiseptic bodies, such as optochin, concentrate of iodine, or acriflavine solution, or the intra-muscular injection of prontosil (page 700), is justified by the modicum of success which these measures have afforded.

The Kolmer Serum-Optochin Method. A mixture consisting of 20 c.c. of Felton's concentrated pneumococcic antibody globulin (Type 1) and 1 c.c. of 1 in 100 sterile optochin hydrochloride may be injected daily for 3 days into each common carotid artery, the dosage being ½ c.c. of the above mixture for each kilogram of body-weight. Cisternal puncture and drainage should follow immediately on the carotid injection, and the same dose of the serum-optochin mixture should be administered cisternally: 6–8 c.c. of human serum (complement) may also be mixed with the above mixture and injected at the same time. An intra-dermal serum sensitivity test should be done previously, and if found to be positive, desensitization should be carried out before the intra-arterial injection is given.

Pregl's Concentrated Iodine Method. This procedure may be carried out in the manner described on page 718.

Drainage Treatment. Continuous cisternal drainage has been tried as an alternative to the foregoing method: it is effected by inserting a drainage tube in the cisterna magna, running off the cerebro-spinal fluid and replacing it with normal sterile saline solution by the drip method (page 715).

Influenzal Meningitis.

Like other forms of pyogenic meningitis, the influenzal type proves very fatal in the case of infants and young children. In the former the mortality is as high as 98 per cent, and in the latter it is between 90 and 92 per cent, so that any measures, however drastic, which hold out any possible prospect of effecting a cure are justified. Either Pfeiffer's influenzal bacillus, or one very like it is usually regarded as the responsible organism in this disease, although the part which a specific filter-passing virus

may play in producing the primary infection must not be lost sight of, but most authorities are agreed that Pfeiffer's bacillus, either alone or along with the pneumococcus and streptococcus, is responsible for the more serious symptoms, and the high mortality. It has been stated that no case[1] has survived in which Pfeiffer's bacillus has been discovered in the cerebro-spinal fluid.

Treatment. *Prophylactic.* The child should be removed from all sources of possible infection. Resistance may be increased by large doses of vitamin A, and the nose and naso-pharynx can be sprayed with Parolein spray compound (B. W. & Co.), or Fecto (P. D. & Co.) in a 1 to 12 dilution. During times of epidemic, or in the case of infected households, the danger to infants and young children from influenza, and its potential meningeal involvement is so great, that protective inoculation is justifiable. Under such conditions the vaccine most often employed, and probably the most suitable for the purpose, is that of St. Mary's Hospital Mixed Vaccine. It should be injected in three doses at weekly intervals, or more often under urgent conditions, in successive doses of 0·02 c.c., 0·04 c.c., and 0·08 c.c.

Curative. The general line of treatment should be conducted as advised under the heading Influenza (page 408).

The specific treatment of the meningitis itself as carried out in this country consists in the hypodermic injection of the mixed vaccine in doses of half those recommended above for the prophylaxis. It may very suitably be combined with a blood transfusion, preferably of convalescent serum, if such can be obtained. In America H. K. Ward's method is practised. The details of the procedure are as follows:

Ten to thirty c.c. of influenzal serum and 6–8 c.c. of sterile human serum (complement), mixed just before injection, are introduced intra-spinously twice daily: firstly by lumbar puncture, and secondly by cisternal puncture, and this treatment should be continued as long as organisms are present. At each treatment, as much cerebro-spinal fluid as possible should be withdrawn and the amount of serum introduced to take its place should be 5 per cent less in volume. Before commencing this treatment it is wise to make an intradermal sensitivity test. The intramuscular injection by prontosil is worth trying (see page 699).

Meningitis of Mumps.

Inflammation of the meninges may supervene in any case of mumps, usually about the 4th day. The cerebro-spinal fluid is

[1] A successful case has recently been reported. It was treated with prontosil. *Brit. Med. Journ.*, May 22, 1937, p. 1085.

sterile, but shows a lymphocytosis. This type of meningitis must be distinguished from meningismus, or simple irritation of the cerebral membranes. In babies and young children it may occur without the pathognomonic symptom of inflammation of the parotid gland. This makes the diagnosis difficult, but it may be suspected when an infant or young child has been exposed to infection, and there is nothing else to explain the symptoms. This form of meningitis is one of the least fatal, and as a rule the child recovers.

Treatment. *Prophylactic.* This is the same as for the parent disease. Convalescent serum is in my opinion quite as valuable as a prophylactic against mumps itself, as measles convalescent serum is against measles.

Curative. The general treatment is the same as that for the parent disease, and includes the use of convalescent serum, if such is available. The meningitis itself is best treated by repeated lumbar puncture, and the substitution of normal saline for the cerebro-spinal fluid withdrawn.

Syphilitic Meningitis.

In syphilitic meningitis the cerebral cortex as well as the meninges is usually involved in the specific inflammatory process. Pachymeningitis, or involvement of the dura without concomitant implication of the pia and arachnoid is rare, although it does occasionally exist. Syphilitic meningitis runs a very chronic course, generally to a fatal termination. The diagnosis is made by the manifestation of ordinary luetic symptoms in the mother or child, and can be confirmed by Wassermann Test.

Treatment. Both the prophylactic and the curative treatment is that for the parent disease (pages **162** and **444**).

Serous Meningitis.

This generally represents an extension of the inflammation to the meninges from infected middle-ears or mastoid cells. It may be local or generalized. If local, the chloride content of the cerebro-spinal fluid is normal. This is important, because the prognosis of localized serous meningitis is good, whereas when it is generalized, it is almost always fatal. The diagnosis is not always easy, and it may be confused with meningismus. The cerebro-spinal fluid is generally sterile, but may contain a few organisms of low virulence.

Treatment. *Prophylactic.* Attention must be directed to the possible existence of ear or mastoid trouble, and if found it must be energetically treated.

Curative. When localized, the prognosis is hopeful, but any

existing ear or mastoid trouble must be treated energetically. The meningitis itself may be treated by repeated lumbar puncture, or continuous cisternal drainage.

Meningismus.

Meningismus, is a condition in which there is evidence of meningeal irritation without any attendant changes in the cerebro-spinal fluid. The latter is sterile, and the irritation is due not to the presence of organisms, but to circulating toxins, produced at a distance or by acute infections, such as lobar pneumonia, and scarlet fever.

Treatment. *Prophylactic.* This consists in the energetic treatment of the parent disorder, which may be the precursor of meningeal irritation.

Curative. This mainly consists in treating the primary infection, while meningeal symptoms may be treated by bromides, chloral, or other sedatives in full doses, and the application of evaporating lotions to the head.

Intra-Cranial Abscesses

Abscesses of this kind may be—

1. Extra-dural and localized.
2. Intra-dural and localized.
3. Diffuse or generalized.

Infection may take place by direct or indirect means, that is to say, by extension, or through the blood or lymph stream. The diagnosis is difficult and should be referred to a neurologist. It is indicated by the existence of pressure symptoms, which include headache, vomiting, drowsiness, papillœdema, nystagmus, monoplegia, hemiplegia, aphasia, disturbance of reflexes, etc. In addition to these there are all the usual indications of infection. Some of these are general, others localized. Among the former are blood and cerebro-spinal fluid changes, with such constitutional symptoms as pyrexia and rapid pulse. Localizing evidence is afforded by the presence of otitis media, mastoiditis, frontal sinusitis, osteomyelitis, or bronchiectasis. The usual seats of the abscesses are in the cerebellar or temporo-sphenoidal region.

Treatment. *Prophylactic.* This consists in the early and energetic treatment of any of the above conditions known to be potential sources of secondary brain abscesses. Otitis media and mastoiditis are the most frequent causes of cerebral abscesses in babies and young children, but they are often very difficult to detect. (For their diagnosis see pages 659 and 664.)

Curative. This is essentially surgical and presents great diffi-

culties as regards the exact localization, time for operation, and method of drainage, and after-treatment. The services of a neurological surgeon should in all cases be requisitioned.

Tumours of the Brain

(Cerebral Tumours, Intra-cranial)

Tumours of the above type are rare under 1 year of age. In children over this age they are situated for the most part in the cerebellum, sub-tentorially, or in the neighbourhood of the pituitary gland. They take the form of gliomata, pituitary adamantinomata, adenomata, tuberculomata, or nævoid tumours (meningeal hæmangiomata, nævoid imbecility).

A correct diagnosis as regards the exact situation and nature of the tumour is essential for treatment. The diagnosis is assisted by repeated ophthalmological examinations of the disc, by analysis of the physical signs and their order of appearance, by examination of the cerebro-spinal fluid, by stereoscopic X-ray pictures, and ventriculography, namely, by replacing the fluid contents of the ventricles with air and subsequent X-ray examination.

The distinguishing signs of cerebellar involvement are:

1. Ataxy.
2. Hypotonia.
3. Postural and ambulatory defects.
4. Nystagmus and ocular paralyses.

The signs of pituitary tumour are visual defects, adiposity, infantilism, increased sugar tolerance, polyuria, polydipsia, internal hydrocephalus, and enlargement of the sella turcica.

Tumours of the mid-central region, basal ganglia, 3rd ventricle, corpora quadrigemina, and crus, give rise to characteristic pressure symptoms, depending on their anatomical relationships.

Treatment. *Prophylactic.* There are no known preventive measures against cerebral tumours, except in the case of tuberculomata, and the prophylaxis in this type of case consists exclusively in avoiding the ordinary dangers of tuberculous infection.

Curative. Desperate diseases require desperate remedies, and for this reason exploratory operations should be undertaken in the hope that if the presence of a tumour can be diagnosed and its position localized, it may perhaps be one of the rare forms which are removable, as for instance an astrocytoma. Subtentorial decompression often affords temporary relief from headache, as also does the slow intravenous injection of 25 c.c. of

hyper-tonic saline, consisting of 50 per cent glucose solution, or 20 per cent chloride solution. Some cases are benefited by deep-ray therapy, while endothermy has made intra-cranial surgery less hazardous.

DEGENERATIVE DISEASES OF THE CENTRAL NERVOUS SYSTEM

Among the degenerative diseases of the central nervous system must be included amaurotic family idiocy, heredo-familial ataxy (Friedreich's disease), progressive lenticular degeneration, cerebellar ataxy, infantile muscular atrophy (Werdnig-Hoffmann's disease) and amyotonia congenita (Oppenheim's disease). The chief points of interest in these hereditary or familial diseases are the diagnosis, prognosis, and pathology.

As regards treatment, little can be done by prophylactic or curative measures to mitigate or cure the disease, and for these reasons they will not be further considered here.

Myopathies

(Muscular dystrophies)

These are diseases of the muscular and neuro-muscular system. They belong to the heredo-familial group of myopathic diseases, and include a number of variations of what is probably a single type. They differ however considerably as regards their anatomical distribution, and as such they receive a variety of names, which according to one classification is as follows:

1. The Pseudo-hypertrophic type.
2. The Juvenile type (Erb).
3. The Facio-scapulo-humeral type (Landouzy-Dejerine).
4. The Distal type (Gowers).
5. Dystrophia Myotonica.

Nothing can be done in the way of treatment, either prophylactically or curative, and the same is true of the congenital absence or atrophy of individual muscles, of myositis ossificans, of myositis fibrosa, and of dermato-myositis.

DISEASES OF THE PERIPHERAL NERVES

Apart from birth injuries, which have already been referred to amongst the diseases of the new-born, and congenital paralyses of the cranial nerves, there are few diseases of the peripheral

nervous system which call for description in this book, since for the most part they are congenital, or otherwise outside the range of treatment. Various paralyses can occur as the result of diphtheria, but little can be done in the way of treatment except to prevent stretching of the paralysed muscles, and to keep the child at complete rest. Various forms of polyneuritis of toxic origin occur in children following on the acute infectious fevers.

Von Recklinghausen's disease, or neuro-fibromatosis is also a disease of the peripheral nervous system which occurs occasionally in infants and children. It is a congenital or developmental abnormality and little can be done by way of treatment.

Finally, pink disease is another pathological entity which is sometimes included among the diseases of the peripheral nervous system, because the symptoms of polyneuritis dominate the clinical picture. But in spite of its very doubtful etiology it has been included among the Deficiency Diseases and a description of it will be found on page 91.

FUNCTIONAL DISEASES OF THE NERVOUS SYSTEM

The Nervous Child

The term " nervousness " as applied to children covers a great variety of types, from those who are bright, sensitive, intelligent children, to those who are dull, negativistic, and ill-tempered, perhaps bordering on mental defectiveness. Consequently, the term " nervousness " need not necessarily carry with it any stigma of reproach, for as the late Sir Clifford Allbutt so frequently insisted, the function of the nervous system is to be irritable; indeed all the great achievements of this world have been accomplished by people who in this sense might be described as " nervous," and have possessed brains or nervous systems which were hypersensitive, or unduly responsive to the events of the environment.

The nervous class of child includes those who are hysterical, emotional, timid, fidgety, obstinate, or difficult to manage. Their condition is partly due to inherent qualities in the nerve cell, and partly due to environment, that is to say, to their up-bringing or general treatment. There can be no doubt that a great deal of nervousness met with in young children is artefact, and due to mismanagement during the highly impressionable period of growth. Mismanagement can take various forms, either physical or psychical, the former including bad feeding, or deficient supplies of vitamins; and the latter, over-stimulation, over-excitement,

want of sleep, and want of rest. The stimulating influences and the interactions of incompatible temperaments are prolific causes of nervousness in children.

Treatment.

Both prophylactic and remedial treatment must take account of the foregoing etiological factors.

Prophylactic. Preventive treatment consists in preserving the nervous system from all sources of shock or irritation. Central causes include the direct irritation of the nerve cell by poisons circulating in the blood, or by deficiencies in the various elements which are required for its normal nutrition. Peripheral causes are exciting incidents or events in the environment which interfere with sleep or rest. Reflex irritation from skin conditions such as eczema or scabies, or of the mucous membrane by catarrhs, worms, or indigestible food, is also a frequent source of damage to the developing nerve cell. All these factors must be taken into consideration in the preventive treatment of nervousness.

Curative. The curative treatment is beset with immense difficulties, and naturally includes the prophylactic considerations mentioned in the above paragraph.

The general psychical and physical environment of the child should receive careful attention. The nervous system should be as little stimulated and irritated as is compatible with the conditions. The personal element in the entourage is most important, and most difficult to control. Mothers frequently get on their children's nerves, while a neurotic nurse may fidget a baby into a condition bordering on frenzy.

The general treatment as regards feeding, exercising, airing, sleeping, clothing, etc., should fulfil the principles of good mothercraft, and should include special attention to physical development by means of specially devised exercises, drill, and gymnastics.

Drugs are unimportant elements in the treatment, but conditions of acidosis, spasmophilia, and calcium deficiency, should be treated on appropriate lines; constipation by petroleum preparations; indigestion by pancreatic extract, soda and rhubarb; and sleeplessness and excitability by bromide.

It is unfortunately the fashion nowadays to treat all children of the atonic and nervous type with large quantities of glucose, irrespective of the special conditions, and irrespective of the sugar concentration in the blood. Many of these nervous children suffer from a condition of hyperglycæmia which is of course accentuated by the glucose treatment, and many others suffer from a defective excretion of waste products, which is in no way helped by glucose. Further, it should be remembered that all carbohydrate food,

whether it be of a farinaceous, starchy, or sugary nature, is ground down by the mills of metabolism to the one common denominator —dextrose, or what is the same thing—glucose. It is therefore a matter of indifference what form the carbohydrate food assumes —that is to say, whether it is starch, cane sugar, malt sugar, fruit sugar, milk sugar, or glucose, so long as it is converted by the ordinary processes of digestion into the only form of sugar which can be utilized by the body—*i.e* glucose. The belief therefore that glucose has some special therapeutic virtue not possessed by other carbohydrates is a delusion and a snare.

The one advantage of glucose is that it requires no further digestion before being absorbed. This advantage, however, is somewhat elusive if the powers of digestion are good. Moreover, by taking large quantities of glucose the blood may be suddenly flooded with an excess of sugar which is difficult to dispose of, whereas a more sustained supply is afforded if there is some delay in the conversion of an insoluble form of carbohydrate, such as starch, into the soluble and available form—glucose. The chief virtue in the glucose treatment is that it fosters a distaste for protein food, excess of which is no doubt one of the chief causes of nervousness, owing to the fact that products of its decomposition in the bowel, or of its metabolism in the tissues, may be a source of irritation to the nerve cell, especially if these waste products are not promptly eliminated by the processes of excretion.

Spasmodic Functional Neuroses

Nervous children are liable to acquire one or other of a large number of different tricks or habit spasms, which though usually included among the spasmodic functional neuroses are most difficult to classify on any more precise basis. One classification subdivides them into "gratification" and "irritation" habits, the former including nail-biting, tongue-sucking, rumination, and masturbation, all of which afford some satisfaction and some degree of pleasurable sensation to the participant, while the latter group includes such unbecoming tricks as blepharospasm, hair-pulling, pica, and dirt-eating, most of which habits result from some primary source of irritation, and finally grow into automatic habits over which the child has no voluntary control, and of which he is as a rule entirely unconscious.

In the following pages no attempt will be made to classify such habits on any systematic basis. Closely allied varieties will be included in the same group, but for the most part each individual habit will be separately described in an independent section.

Blepharospasm.

With this habit must be grouped certain other spasms or tics of the ocular apparatus, such as nictitation, screwing up the eyes, frowning, raising the eyebrows, blinking, and winking. Most of these are due to spasmodic contractions of the orbicularis muscle, although they are sometimes associated with simultaneous spasm of the occipito-frontalis. The habit is usually contracted in consequence of some primary source of irritation, such as phlyctenular ulcer, keratitis, fissure at the corner of the lids, errors of refraction or in-growing eyelashes. It may also result from exposure to a bright sun or strong lights without the protection of a hat or other form of shade, or it may arise from imitation of some individual similarly afflicted.

Treatment. General treatment consists in dealing with the underlying "nervousness" (page 547). Specific treatment depends on the removal of the cause. The result will probably depend on the length of time the habit has been in existence, on its dependence or otherwise on some remediable cause, and on the age of the patient. The seriousness of a tiresome trick of this kind, which may persist throughout life if not corrected in its early stages, justifies the taking of any step, however drastic, which holds out any prospect of success. It is possible sometimes to break the habit by bandaging the eyes and keeping them covered for a prolonged period, say 10 days or a fortnight, followed by the wearing of smoked or tinted glasses. Naturally any concomitant error of refraction must be suitably treated with glasses.

Histrionic Spasms.

This class of spasm includes a number of tics of the muscles of expression, such as grimacing, facial contortions, pantomiming, posturing, showing the teeth, elevation of one corner of the mouth, shrugging the shoulders, twitching the nose, dilating the nostrils, or moving the ears or the scalp. Such habits are liable to develop on slight provocation in emotional and imitative children.

The exciting cause may be some severe emotional disturbance or fright, or some source of physical irritation, as an ulcer within the nose, a sore at the corner of the mouth, painful dentition, or toothache.

Partially blind babies are very liable to contract the habit of waving their hands in front of their eyes, since the stimulation thus afforded to the retina provides some degree of sensuous gratification.

Treatment. Treatment consists for the most part in the removal of the cause, if this can be discovered. The soothing effect of bromide on the nervous system is often a help in the

treatment, and the relief of such a contributory cause as teething often has a favourable influence on the spasm itself. The kind of curative or disciplinary treatment which is most liable to succeed will depend very largely on the age of the sufferer, but in any case the misfortune should not be allowed to get upon the child's nerves. Punishment or ridicule are equally inefficacious as means of treatment.

Better voluntary control of the affected muscles may be acquired by encouraging the child to practise slowly in front of a mirror movements of the muscles corresponding to or antagonistic to those involved in the neurosis itself. It is important to discover whether the spasm occurs when the child's mind is unoccupied, or whether it develops when the child makes some special mental or physical effort. The line of treatment to be adopted will depend on the finding.

Head-Nodding.

This habit, like head-banging, head-knocking, and body-rocking is particularly liable to develop in mentally defective infants, in fact it may be the earliest indication which points to amentia. Its indulgence seems to give some sort of gratification which is open to these afflicted children, and which cannot be provided by more reasonable or profitable sources of amusement. The movements are not easy to restrain, but less objectionable outlets for their energies may be provided if they can be persuaded to play with a rattle, or to turn the handle of a musical box. The habit may however develop in perfectly normal children owing to the irritation of the scalp by seborrhœic conditions. Seborrhœa often exists in so mild a form that it escapes notice, unless very carefully searched for. At first its only symptom may be a little scurfiness, redness of the scalp after the bath, or slight enlargement of the occipital glands. Other causes of head-rolling are otitis media, and the cutting of the temporary molars.

The treatment of such cases must of course be directed to the cause.

Tongue-Sucking.

This habit is very frequent in mongol babies, and it is largely due to the fact that the tongue is too large for the mouth, and projects beyond the alveolar process of the jaws, or even out of the mouth. The habit is a difficult one to break, but it can sometimes be restrained by keeping the mouth closed by means of a bandage applied under the chin and fixed over the vertex.

Thumb-Sucking.

This habit, like that of dummy-sucking, is one which grows by what it feeds on. It soon becomes a very intractable tic, and

every effort should be made to stop it owing to the fact that deformities of the jaw, and projecting teeth, are possible consequences of its indulgence.

The treatment consists in making it impossible for the infant to insert his thumb in his mouth, by splinting the elbows, or pinning the arms down by the sleeves. The restlessness and annoyance at first caused by such restraint must be met by bromides or other sedatives.

Nail-Biting.

This habit seldom develops under 3 years of age. It is a habit which is very easily checked at the beginning, but very difficult to cure when it has become firmly established. The old-fashioned method of treatment by painting the tips of the nails with a solution of aloes is in my experience quite useless, so also is the wearing of gloves, but if the tips of the latter are impregnated with a strong solution of mustard, the habit is usually quickly relinquished.

Nose-Picking.

This gratification neurosis, like that of picking the fingers, generally results from some definite source of irritation, such as an ulcer of the septum, or the nose, or inspirated mucus within the nasal chamber. It can only be cured by constant vigilance and the restraint afforded by physical or psychical correction. As the picking usually occurs quite unconsciously and automatically, a gentle reminder afforded by attaching an elastic to the wrist and fixing it to the side of the clothing may be sufficient to bring the act into the sphere of consciousness and consequently lead to its abandonment.

Hair-Pulling.

This habit, like wool-eating, dirt-eating, and other forms of pica, is not infrequently in my experience a symptom of some avitaminosis, especially scurvy. I have come across several cases of hair-pulling in children suffering from sub-scorbutic and cœliac conditions, which have been rapidly cured by providing adequate quantities of the vitamin B complex and vitamin C. On the other hand, pica may occur in mentally defective children, and when it does it cannot be cured by this simple means, and it must be treated as a symptom of the mental disorder.

Air-Swallowing.

The air-swallowing habit is occasionally acquired accidentally by nervous infants, and gives rise to rumbling and gurgling noises in the stomach and intestines (borborygmi) which are due to inco-ordination of the motor functions. It may owe its origin

to the taking of food too fast, or to ineffectual attempts to suck through an artificial nipple which is provided with too small a hole.

The treatment is difficult, and must be directed to removing the cause, if such can be found. As a rule no such cause can be found, although it may have existed originally. Sometimes drawing off the milk in the case of breast-fed infants, and giving it by a spoon; or in the case of bottle-fed infants temporarily dispensing with the bottle and substituting a feed of some other sort, will get rid of the habit. I have found the use of a lubricant, such as petroleum combined with certain sedatives a great aid in the cure, and I have been in the habit of employing a mixture containing belladonna, bromide, opium, dill water, and petroleum emulsion for this purpose.

Rumination (Merycismus, Posseting, Chewing the Cud).

This is a common gratification habit acquired by infants; it seldom exists however after the 1st year of life. It consists in a deliberate effort to expel the contents of the stomach by bringing into play the recti-abdominis and other extraordinary muscles of expiration. The glottis is kept closed and the œsophageal opening of the stomach is relaxed at the moment of supreme effort. Infants often become experts at this form of vomiting and it appears to afford them a considerable amount of pleasure. The vomiting as a rule is not of the projectile type: the contents of the stomach flow gently into the mouth, where it is sometimes retained, rolled about, and then again swallowed.

The treatment of these cases when the child is artificially fed is comparatively easy, and consists in substituting undiluted condensed milk for the ordinary milk dilutions. The equivalent quantity of condensed milk is so small that the infant finds it quite impossible to project it out of the stomach by any voluntary effort. The milk should be given by a spoon, and the quantity carefully regulated so that it constitutes a satisfactory equivalent for the relinquished dilution. Fluid may be supplied independently of the condensed milk, about 2½ hours after the " thickened " feed. It should consist of water sweetened with a little sugar, and flavoured with orange-juice or Bone and Vegetable Broth. At first the infant eructates part or whole of the fluid, but derives so little gratification from the result that he soon relinquishes the habit. In estimating the amount of condensed milk required as a substitute for the ordinary feed it should be remembered that the caloric value of the ordinary sweetened variety is 100 calories per oz. by weight, that is to say, five times the caloric value of either breast milk or its equivalent in diluted milk, and consequently should be supplied in one fifth of the amount.

In the case of breast feeding, this should be temporarily abandoned while the cure is in progress, and in the meantime the mammary glands should be kept in functional activity by means of " expression."

Masturbation (Thigh-rubbing).

This habit is very common, especially in female babies. It may take the form of rubbing the thighs together, wriggling about in bed, or if the child is old enough to sit up, by oscillatory movements against the edge of a chair or other hard object. During the execution of these movements the child's face generally becomes flushed and perhaps breaks into a profuse perspiration, the breathing is hurried, and there is sometimes a definite orgasm followed by a period of exhaustion. In the case of male children the movements take a slightly different form, and there is as a rule no orgasm.

It is generally believed that this objectionable and exhausting habit results from some form of local irritation, such as adhesions of the prepuce or clitoris, from tight clothing, thread worms, or inflammation of the urinary meatus, and that treatment should consist of the removal of the cause. My own personal experience is that such sources of reflex irritation are seldom to be found when the child comes up for examination, although it is just possible that they may have been a factor in the original contraction of the habit.

The treatment is difficult and usually has to consist in providing some form of mechanical restraint, such as tethering the hands if they take part in the habit, or by providing sleeping-suits, or by some sort of basket-work cage which prevents access to the external genitals. Very considerable patience and vigilance is usually required in effecting a cure by psychological or disciplinary methods, but I have known cases in which resourceful nurses have effected a cure by the exercise of firmness and corrective suggestion. If such means can be applied effectively they are very much better than any form of mechanical restraint. Drugs are of little use by themselves, but sedatives such as bromide may help in keeping the child quiet when a corrective mechanical apparatus is first applied.

Noise-making Habits.

Habits such as sniffing, coughing, grunting, barking, etc., may be contracted by quite young infants owing to some definite cause, such as local irritation, or occasionally by imitation. I have known babies imitate many weird sorts of noises, such as the whistling of locomotives, or the sound of fog-horns. Such habits when once contracted are difficult to cure, unless a rival

reflex competes for ascendancy, for instance, the development of an ordinary cough may effect a cure of a habit of sniffing. I remember an attack of hay fever accompanied with repeated sneezing supplant a habit of grunting. In the case of children sufficiently old to concentrate I have found singing lessons very helpful in getting rid of certain forms of this habit.

There are other noise-making neuroses which should perhaps be included in this group, such as congenital laryngeal stridor, holding the breath, and laryngismus stridulus. These spasmodic neuroses have no gratification significance, nor have they any irritative basis. They depend for their manifestation on some inherent defect, or instability of the nervous system, such for instance as is met with in spasmophilic conditions.

Constant Crying.

Incessant crying in infancy, under conditions of normal health, usually implies the acquisition of a bad habit. A habit of this kind is of course more frequently acquired by mentally defective infants than by those who are normal, but incessant crying is the most frequent symptom for which infants are brought to hospital, and for that reason it is very important to be able to recognize that this symptom does not necessarily mean that there is anything seriously wrong with the child, and that it may merely represent a bad habit. The habit is difficult to get rid of, but as the infant grows older there is a tendency for progressive improvement to occur.

Crowing.

Crowing only occurs in young babies. It is occasioned by the sucking into a narrow glottis of the arytæno-epiglottidean folds, and the trick is either due to nervous inco-ordination, or to an exaggeration of the normal flexibility of the upper opening into the larynx. This perverted habit of noisy breathing is occasionally associated with obstruction to the entry of air, temporary cyanosis, and permanent thoracic deformity. As the parts affected acquire greater rigidity with the increasing age of the child, the type of breathing assumes the normal. It is seldom that crowing persists beyond the 3rd or 4th month. The management of these cases must be directed towards the underlying nervousness which usually accentuates, if it does not cause the perverted method of breathing. The symptom is intensified by excitement, or effort, as by crying, coughing, or suckling. The administration of bromides reduces the nervousness, and probably favourably influences the co-ordination of the respiratory efforts.

The successful treatment during an attack depends on allaying the nervousness of the child, and quietening its excitability. A

whiff of chloroform combined with inhalations of oxygen to relieve the cyanosis often act like magic, but a more sustained effect can be produced by giving 1–2 gr. of chloral hydrate.

Laryngismus Stridulus.

This is one of the pathognomonic manifestations of the so-called spasmophilic state, sometimes described as tetany, but which in any case depends on deficient blood calcium. Apart from the specific treatment of the spasmophilia by the administration of calcium lactate and phosphorus, the management of these cases should be conducted on the same lines as that recommended for crowing in the above paragraph.

Holding the Breath.

This is a very frequent symptom in spasmophilia, and it is very often its first and only indication. In severe cases the symptoms are often alarming and give rise to great anxiety, but in spite of prolonged holding of the breath, even until a condition of cyanosis supervenes, life is in no way jeopardized.

In my younger days I met with so many of these cases amongst the children of my medical friends that I thought there must be some causative factor associated with their upbringing which was responsible for the coincidence. Since however this neurosis has been recognized as a symptom of spasmophilia and calcium deficiency, the number of cases which I have met has been considerably fewer, and the treatment administered more immediately effective. The specific treatment of course is that for spasmophilia (see page 559). The immediate treatment, like that of other forms of laryngeal spasm, is to give a few inhalations of chloroform.

Enuresis.

Enuresis, both in its diurnal and nocturnal forms, deserves to be included in the category of bad habits, but strictly speaking it represents not the acquisition of a bad habit, but the persistence of an infantile one which should have been relinquished at a comparatively early age when the function of micturition comes under the influence of volition during waking hours and under that of the sub-conscious mind during sleep. Full particulars of the treatment are given on page 344.

Convulsions

The view is often expressed that convulsions are either symptomatic or idiopathic, implying that the former are due to some definite cause, while the latter are independent of it. It seems to me that this is a very arbitrary classification. On the other hand, some authorities believe that in all cases of epilepsy, that

is to say in all cases of recurring convulsions, there is some definite organic basis for the seizures. My own personal view is that the frequent repetition of convulsions, from whatever cause arising, may ultimately result in the establishment of a habit in which the existing cause may be negligible, but the predisposition so great, that the attack almost deserves the epithet idiopathic or spontaneous.

Whether a convulsion takes place or not as the result of cerebral irritation depends on two factors—the intensity of the eliciting stimulus, and the degree of irritability of the brain, in other words, on the relationship of these two factors.

In epilepsy, the degree of susceptibility to stimulation of the cortical nerve cells is so great that a convulsion takes place on such insignificant provocation that it may almost be said to occur spontaneously. In the case of normal infants, or children, the stimulus necessary to produce convulsions is generally very considerable. In cases of congenital mental defect, the cerebral nerve cells are so unstable and irritable that convulsions occur from insignificant causes, and are apt to become habitual, in other words, the child is liable to develop into a chronic epileptic. Transient and temporary varieties of instability and irritability of the cerebral cells are apt to arise under certain conditions, as for instance in spasmophilia, in which the nerve cells become unduly excitable owing to a low calcium content in the blood (status calciprivus), or when the central nervous system has been subjected to long-continued or frequently repeated reflex irritation, as in primary dentition, intestinal colic, worms, eczema, or acute infections. Under such conditions of raised excitability convulsions occur which would not have taken place under normal conditions.

Infantile Convulsions.

Convulsions are very apt to occur during infancy owing to the unstable condition of the whole of the nervous system. They are specially liable to develop in children of neurotic stock, in mental defectives, and in spasmophilic conditions, due to rickets, tetany, status calciprivus, etc. The exciting cause, or eliciting stimulus may be any form of reflex irritation, such as that arising from colic, intussusception, trauma of the central nervous system, acute infections, hæmorrhage, inflammation of the meninges, encephalitis, cerebral tumours, sunstroke, uræmia, vomiting, irritant drugs, fits of temper, hypoglycæmia, and hyper-pyrexias.

Treatment.

Prophylactic. The preventive treatment must take into account both the etiological factor of predisposition, and the inciting

causes as enumerated above. Inasmuch as the treatment must depend largely on whether the convulsions are due to reflex irritation, and therefore presumably amenable to treatment, or whether they are consequential on some inherent instability of the central nervous system, and as such beyond the reach of cure, it is of the utmost importance to make a correct diagnosis of the underlying cause. I have often seen an infant diagnosed as an epileptic, in whom on inquiry it has been found that the underlying cause was one of intestinal irritation, and the convulsions purely temporary and curable. In the same way that the precise method of treatment varies with the cause, so also to some extent will it vary with the age of the patient, for the reason that the cause itself is closely associated with the age. Thus when convulsions occur in an infant under 1 month of age, the cause is probably a cerebral hæmorrhage (55 per cent), birth trauma, cerebral œdema, mental defect, hydrocephalus, or intestinal colic due to bad feeding. Convulsions occurring in infants between 1 and 6 months are generally caused by an attack of some acute infection (35 per cent). In infants between 6 months and 3 years the cause of convulsions generally lies between an acute infection, dentition, spasmophilia, cerebral tumour, meningitis, or encephalitis.

It is quite obvious that convulsions due to many causes such as hæmorrhage, infection, or mental defect, cannot be provided against by any ordinary prophylactic measures, but convulsions developing in nervous children from acquired causes such as difficult dentition, and spasmophilic states, can to a certain extent be anticipated and prevented by appropriate measures and correct feeding.

Curative. The general treatment of the underlying nervous condition of children subject to repeated convulsive seizures must be conducted on the lines described for nervous children (see page 547).

The specific and immediate treatment of the attack will depend on the cause. When due to hæmorrhage or obstetric trauma little can be expected from treatment. If, however, it is true as Dr. Robert S. Frew [1] has suggested, and as I personally believe, that cerebral hæmorrhages in the new-born are mainly due to the fact that the vascular system is over-distended with blood (hyperphlebœmia), the rational treatment is obviously to bleed the patient. Short of this, however, lumbar or cisternal puncture will relieve intra-cranial pressure and thus mitigate the convul-

[1] "Disease in Childhood (The First Year)," p. 97. Macmillan & Co., London, 1936.

sions, while the intra-muscular injection of a small quantity of blood or hæmostatic serum may promote coagulation and thus help to control the extent of the bleeding. In one case of hæmorrhage in a new-born infant with continuous convulsions in which I was confident of the diagnosis, I advised trephining and the removal of the blood clot. The operation met with qualified success, and the child now at the age of 10 years is still alive, though a chronic epileptic.

Convulsions of the New-born due to Cerebral Œdema.

The treatment in these cases is—

(1) Lumbar or cisternal puncture.

(2) The slow introduction of 2–3 oz. of a 10 per cent saline solution of Hypertonic Saline into the rectum of the baby.

The child must be kept absolutely quiet and moved as little as possible. It should be fed by means of a pipette or syringe with milk expressed from the mother.

Convulsions due to Acute Infections.

Convulsions of this variety are usually of short duration and are seldom repeated. If very violent a whiff of chloroform generally proves of immediate advantage.

In mild cases 1 gr. of phenacetin often acts like a charm. Provided the temperature is not high the child may be given a hot bath. If it is high the child should be sponged. I was once called to the case of an infant in a condition of violent convulsions who had been placed in a hot bath although his temperature was at the time over 107° F. This suggests the dangers of applying any routine treatment for convulsions.

Convulsions due to Cerebral Tumours.

Surgical intervention holds out the only prospect of relief.

Convulsions due to Meningitis, Encephalitis, and other Local Inflammatory Causes.

The general treatment should consist in the application of an ice-pack or evaporating lotion to the head, while chloral hydrate or bromide may be given by the mouth. Specific treatment should be conducted on the lines advised under their appropriate headings.

Convulsions due to Dentition, Tetany, or other Spasmophilic Conditions.

Convulsions of this type are generally described as ordinary infantile convulsions. The immediate treatment consists in giving a hot bath if there is no temperature, relieving the bowels by some simple aperient as syrup of figs 1 drachm, or milk of magnesia 2 drachms, or by a soap-and-water enema. Large doses

of bromide, 5–10 gr., may be given by the mouth in combination with bicarbonate of soda, 10 gr., or citrate of potash, 10 gr. In addition calcium lactate should be given in large doses, say 10 or 15 gr. as an initial dose, followed by smaller doses of 5–10 gr. A more immediate result is sometimes attained by the intravenous or intra-muscular injection of 1 drachm of a 10 per cent solution of calcium gluconate. Subsequent treatment consists in dealing with the underlying cause, which is usually a combination of dentition with spasmophilia.

Epilepsy.

I have already explained that in my view epilepsy should not be regarded as a disease so much as a habit or predisposition to convulsive seizures, which may be aroused or excited by trivial causes, and that there is no real distinction in kind between " Epilepsy " and the ordinary convulsions of infants and children, except that in the one case they are more easily elicited and more frequently repeated. At what point any series of convulsive seizures are entitled to be called epilepsy, or when they cease to be convulsions is an academic question which must be very puzzling to those who regard the two conditions as distinctive.

Treatment.

Prophylactic. The prevention of recurrences of convulsions in children depends very largely on the cause. In cases of mental defect or familial predisposition to fits, or when the attacks are secondary to some definite organic lesion, prophylaxis is naturally much more difficult, and unsatisfactory, than when the convulsions are brought on by some powerful exciting cause, which is more or less preventible and curable. But in all cases the frequency of the seizures and their severity can be to some extent mitigated by avoiding all those conditions or events which tend to raise the general excitability of the central nervous sphere, such for instance as intestinal toxæmias, constipation, excitements, nerve strains, and spasmophilic states. Of all practical measures of prophylaxis I believe that the avoidance of overfeeding generally, and more particularly with respect to stimulating foods of the nature of meat, fish, eggs, etc., holds out the best prospect of successful treatment. A diet consisting mostly of fruits, vegetables, farinaceous foods, and milk, and not too much of any of them, is best calculated to have a restraining influence on the attacks. Special precautions should be taken during predisposing periods, such as those of primary dentition, weaning, or infections. All forms of peripheral irritation, such as those due to eye-strain, exposure to bright lights, travelling in train or car, loud noises, or skin irritation, are possible sources

of stimulation. Precautionary measures are necessary to prevent accidents during the fits from fire, water or traffic.

Curative. During an attack itself, precautions must be taken against biting the tongue, or choking through fluid finding its way into the larynx. No drugs should be given by the mouth. Chloroform may be given by inhalation, or chloral 2 gr., or morphia 1/30th gr., hypodermically.

Rectal enemata should be avoided for fear of disturbing the patient. A hot pack is probably better than a bath for the same reason. The duration and the severity of the attack will determine what particular shape the treatment should take. For an ordinary attack it is usually sufficient to place the child in a comfortable position on his side and loosen the clothing round the neck. No special methods of treatment are required when the fits take the form of Jacksonian epilepsy, myoclonus, status epilepticus, petit mal, or pyknolepsy.

Treatment between the Attacks.

The precautionary measures as regards diet and general hygiene referred to under the section on " Prophylaxis " should also be observed in the curative treatment between the attacks.

The question of drug treatment is important, but must be made subservient to the frequency and severity of the seizures. With only occasional fits it would be obviously unwise to keep up continuous drug treatment. Whereas with frequent repetition of them drastic expedients are justifiable in order that the establishment of a " habit " may be avoided. The best results in my experience are undoubtedly obtained by consistent adherence to the bromide treatment. This should be provided by giving the bromides of potassium, sodium and ammonium in equal parts to prevent the disturbance of mineral balance which is likely to ensue when any one of these salts is given singly. The dosage should be from 2 to 5 grains of each, given three times a day. Bromide rashes are occasionally a tiresome complication. The giving of arsenic has a restraining influence. Other manifestations of bromide idiosyncrasy are rare. In very severe cases the giving of luminal (gardenal, phenobarbital) to the extent of $\frac{1}{4}$ grain may be justified, either alone or in combination with the bromides. It is a very powerful drug, valuable in emergencies, but not in my experience a safe one to administer indiscriminately, or for any prolonged period.

In view of the close association between nerve instability and intestinal intoxication, I would once again insist on the rigid restriction of all nitrogenous foods, such as meat, poultry, fish, and eggs, etc., as a remedial, quite as much as a prophylactic

measure, and the taking of all reasonable precautions to ensure intestinal asepsis by such means as the regular administration of creosote (see page 441), the giving of sour milk (lactic acid organisms, see page 695), or a combination of petroleum emulsion and bismuth (see page 692).

Ketogenic Treatment.

Both the starvation method of treatment, and the ketogenic diet, as well as the two in combination, have their respective advocates. Of the first I can speak most highly. With respect to the second I have my doubts, but inasmuch as in intractable cases any experiment is worth trying, the following details of the combined method are given.

If there is any evidence of hypo-insulinism, a relatively low carbohydrate, and a relatively high fat diet is specially indicated ; but in all cases considered suitable for the ketogenic treatment, the first step is to ensure a few days' starvation. In America the usual plan is to allow the child to chew a few sticks of gum during the period of abstinence to allay hunger, and to give daily between 800 and 1,500 c.c. of water. On the 4th day of starvation the ketosis is usually at its height. On the 7th day is started the ketogenic diet proper, and this is maintained at a caloric level of about 40 per cent below normal, and on a basis of 1 part of carbohydrate to 4 parts of fat. This diet should be continued for the best part of a year, and after that the balance may be gradually reduced until it approximates to a one-to-one fat-carbohydrate ratio, with of course the necessary allowance of protein and accessory factors. This method is at all times very difficult to apply in the case of children, and in that of infants necessitates the giving of a dilute cream mixture.

NON-SPASMODIC FUNCTIONAL NEUROSES

Headache

Headaches are undoubtedly a very common symptom in children of all ages, but under 1 year of age they are seldom complained of and have to be diagnosed by circumstantial evidence and inferential deductions. They may be due to organic causes, and under such conditions are usually associated with increased intra-cranial pressure. This class includes attacks due to meningitis, encephalitis, hydrocephalus, microcephalus, cerebral abscess, cerebral tumours, sinus thrombosis, otitis media, and sinusitis. Among the blood conditions which cause headaches must be included anæmia, hyperæmia, pyrexia, and all forms of toxæmia,

including those associated with tonsillitis, enteritis, and nephritis. Recurrent bilious attacks which presumably are associated with, if not actually due to failure of the detoxicating functions of the liver, must be included in this group of causes.

The nervous causes of headache, whether central or reflex, include nervous exhaustion, neurasthenia, hysteria, sunstroke, and train or car sickness.

The diagnosis of the cause is sometimes helped by the distribution of the pain. Frontal headache is suggestive of anæmia, toxæmia, eye strain, or naso-pharyngeal infections. Vertical headache is suggestive of anæmia, hysteria, epilepsy, or meningitis. Parietal headache is suggestive of ear troubles; occipital headache of epilepsy, meningitis, eye strain, pharyngitis, otitis media, decayed molars, and cerebral disease; supra-orbital or frontal headache is very often associated with disease of the nose or frontal sinuses.

Treatment.

Prophylactic. The successful prevention of headache when its existence can be diagnosed in young children is naturally dependent on the cause. In children under 5 years of age the main causes are dentition, recurrent bilious attacks, toxæmias from food or infective causes, sinusitis, together with sea, car, or train sickness, so that particular attention must be paid to the possibility of such factors being present in the etiology, and if discovered they must be treated on appropriate lines.

Curative. In children under 5 years of age headaches should be taken seriously, and treated energetically by putting the child to bed, where he should be kept quiet and free from excitement. A dose of syrup of figs (see page 694) followed by an effervescing saline (see page 694), should be given and the child kept on a semi-starvation diet for a day or two until the headache has disappeared. The diet should consist of weak tea and dry toast, if the child is old enough to eat the latter, with unlimited quantities of barley-water, orange-juice, or lemonade, and grapes. A diet of this kind gives the liver rest, and affords time for the recovery of its detoxicating functions, which, if the failure thereof is not actually the cause of the toxæmia, are often impaired in these cases.

Apart from the direct treatment of the underlying cause, if such can be discovered, the headache itself should be symptomatically treated by giving 1 gr. of phenacetin in combination with 1 gr. of citrate of caffeine. This dose should be repeated in 6 hours if necessary.

Migraine

Definite attacks of migraine of the classical type with prodromata and ocular phenomena rarely occur in children under 5 years of age, but recurrent bilious attacks which later on merge into typical cases of migraine are correspondingly common. Migranous attacks have so many features in common with epilepsy that they have been regarded by some as a specialized form of epilepsy in which the sensory areas of the cortex are involved. It seems probable that migraine represents a vaso-motor neurosis, possibly involving among others the posterior cerebral arteries.

Treatment.

Prophylactic. Typical cases of migraine, as well as antecedent recurrent bilious attacks, are so liable to occur in nervous children, or those of neurotic strain, that this factor in the etiology must be taken fully into account in any rational system of prevention. The underlying state of instability of the nerve cells with a liability to periodic explosions, is influenced unfavourably by many environmental conditions, some of which are amenable to prophylactic measures, as for instance, mental excitement, nervous strain, want of sleep and rest, and above all by blood impurities due to infections, intestinal toxæmias, and failure of the detoxicating functions of the liver. As in the case of epilepsy, so with migraine, starvation methods combined with a dietetic régime mainly consisting of fruit, vegetables, and cereals, undoubtedly improve the prognosis, probably by its restraining influences on intestinal decompositions.

In view of the fact that allergy or protein hypersensibility may serve as a determining cause in eliciting an attack, this possible factor in the etiology should not be overlooked, nor its influence on prophylactic treatment undervalued. Positive reactions to skin tests have been noticed in migranous patients to milk, beef, pork, and eggs, and in a considerable number of these cases there has been an accompanying hypochlorhydria, which should receive its appropriate treatment, namely, the administration of hydrochloric acid or sodium chloride. Too much however must not be expected from this form of prophylactic treatment, as the hypersensibility of the nerve cell is most improbably confined to hypersensibility to a particular protein body. The cause presumably lies much deeper in its hypersensibility to all forms of stimulation.

Curative. The general lines on which an attack of migraine should be treated are the same as those given for headache (see

page 563), namely, rest in bed, avoidance of noise and light, the clearing out of the bowels, strict limitation of all food, with the exception of fruit juices, grapes, barley-water, and glucose.

For the relief of the headache 1 gr. of phenacetin combined with 1 gr. of citrate of caffeine may be given. I have found Cibalgin singularly efficacious. It may be given to the extent of ¼ tablet by the mouth, or an equivalent dose (¼ ampoule), in the form of a sterile solution, may be injected intra-muscularly or intravenously in severe cases. I place no reliance however on the use of nitrite of ahmyl, ergot, strychnine, or chloroform, drugs which are sometimes given. Ice or evaporating lotions applied locally seem to relieve the pain, as also sometimes does a mustard leaf applied to the nape of the neck, but in any case the condition is self-limiting and the attacks usually pass off within 24 hours without further treatment beyond rest in bed, and protection from noise, light, and other forms of strong stimulation.

DISORDERS OF SLEEP

Insomnia

Sleep is largely a matter of habit, and the habit of insomnia is often acquired in early infancy, owing to bad management, which may take the form of allowing the child to be unduly excited before being put to sleep, or to night feeding. Indigestion, or other sources of pain or discomfort also interfere with sleep, and a habit of this kind once begun by nervous children can be continued almost indefinitely, long after the cause which originally induced it has ceased to exist.

Treatment.

Prophylactic. This consists in the observance of the ordinary rules of health and good management, and in the avoidance of those hygienic or nursery errors which interfere with sleep during the night. More often than not the habit of bad sleep is acquired during the first few weeks of life by failure to observe the common-sense principles of good management as regards regular times for feeding, sleeping, and waking. The most frequent mistake of all is the giving of a night feed. A new-born infant should be made so warm and comfortable in his cot that he can sleep continuously from ten o'clock at night until six o'clock the next morning, and during the day the hours of feeding and of sleeping should be so regulated that a fixed periodicity is established in the nerve centres which control these functions. It is in my opinion so important to establish regularity of habit in these

respects during the first few weeks of life that almost any therapeutic procedures which are calculated to achieve the desired end are justifiable. The tormina associated with intestinal dysperistalsis, often described as wind or colic, are in my experience one of the most prolific causes of disturbed sleep in young infants. This should be energetically treated by a mixture of drugs consisting of bismuth, petroleum emulsion, dill water, bicarbonate of soda, and opium, combined in accordance with the formulæ given on page 692. If this does not allay the discomfort sufficiently to allow of sleep, bromide of ammonium may be given in addition, but if it is given at all, it should be given in large doses. I would advise in the case of a new-born baby a dose of not less than 5 grains, given three times daily.

Curative. The two main principles to be observed in the treatment of insomnia are firstly, to realize that insomnia is a habit which must be broken, and secondly, that the cause, or causes, which perpetuate the habit, if such exist, must be discontinued or counteracted.

The remedies which have been given in the previous section on " Prophylaxis " are equally applicable in the cure, and any concurrent condition of intestinal indigestion must be treated by the methods there advised. Attention must also be paid to such possible disturbing factors as enlarged tonsils and adenoids, ear trouble, teething, and Coli infections of the urinary tract. Excitements previous to going to bed, wet napkins, excessive clothing, spasmophilic and other conditions of raised excitability of the central nervous sphere, are also prolific causes of disturbance, and if they exist must be treated by appropriate means.

The drug treatment of the insomnia itself consists in the administration of bromide, but I must repeat the warning previously given that if bromide is given at all it must be given in really large doses. Luminal and other drugs of the barbituric class, although immediately efficacious, are ultimately detrimental.

Excessive Sleepiness

Ordinary healthy sleepiness, which is a perfectly normal symptom during infancy and early childhood, must be distinguished from the drowsiness of narcolepsy, uræmia, diabetes, cerebral disease (especially pituitary disease and encephalitis), as well as that due to drugs. Occasionally children show a tendency to yawning, and sleepiness, when their livers fail in the function of detoxication, or when there is a tendency to acidosis. The heavy sleeping of children who are difficult to wake up in the morning, but who may take a long time to get off to sleep when they go to

bed, is a special condition of its own, and is nearly always due to the narcotic influences of intestinal toxæmia.

Treatment. The treatment of undue drowsiness due to any of the above, or other morbid conditions, must be directed to relief of the underlying cause. Otherwise, the condition requires no treatment, beyond ordinary good nursery and hygienic management.

The administration of a small dose of thyroid, say one-sixth of a grain of thyroideum siccum, owing to its stimulating properties on general metabolism, often has a good effect on children suffering from excessive sleepiness, even though the underlying cause cannot be discovered.

Night Terrors

(Pavor Nocturnus)

There are few distinctions between mild cases of night terror and nightmare, although for the most part they develop in their more typical forms in children of different ages. Night terrors are more common in children under 4 years of age, and nightmares in later childhood. But since the etiology and the treatment of these two conditions is practically identical, the following account may be taken as applying to both.

Treatment.

Prophylactic. In all cases of night terror the underlying condition of nervousness must be treated, on the lines laid down on page 547, with special reference to the avoidance of all forms of mental or physical excitement which can disturb the equilibrium of the central nervous system. Among the psychological causes are excitement or romping before going to bed, and among the physical causes are indigestion, intestinal irritation, worms, and irritation of the skin by eczema or parasites. Among the articles of diet which are specially liable to lead to intestinal irritation, and thus to night terrors, must be included the following—cores of apples, skins of fruit, orange marmalade, beans, peas, large pieces of banana, raisins, currants, pieces of citron, celery, beetroot and carrots. All these should be strictly avoided until such time as the child can be relied upon to masticate them very thoroughly.

Curative. The same precautions advised under " Prophylaxis " must also be observed in the cure. The central nervous system must be spared all forms of central or peripheral strain or irritation. The last meal before going to bed should be of the lightest and most digestible description, certainly not milk. A cup of soup, or a little calf's-foot jelly constitutes a good form of supper.

The eating of raw apples for the purpose of cleaning the teeth is in my opinion a very unsatisfactory method of achieving this end at all times, but especially so at night and it is certainly a prolific cause of indigestion.

As far as drug treatment is concerned, there is nothing better than bromide, given in full doses in combination with bismuth, rhubarb, soda, and liquid petroleum (see page 692). All these may be combined in the same mixture if thought desirable. The formula for this mixture will be found on page 692.

Sleep Walking

(Somnambulism)

The general causes of sleep walking are practically the same as those of night terrors or nightmares, but the symptoms take a more pronounced form, and the child himself is usually of a more neurotic or psychopathic disposition, and more amenable to hypnotic influences. The hereditary factor is an important one, but sleep walking is seldom indulged in by children under 5 years of age, although the habit does occasionally develop earlier. Older children who eventually become sleep walkers have often developed symptoms of night terrors when they were younger.

Treatment.

Prophylactic. Preventive measures must take into consideration the unstable and impressionable condition of the central nervous system and its ready responsiveness to all forms of psychic and physical stimulation. It is impossible for children with this tendency to lead too simple and too uneventful lives. The management must be extremely judicious to save them from all forms of psychological disturbances. If children under 5 years of age take to sleep walking the exciting causes are often found to be parties, journeys, new nurses, unpleasant sights, ugly pictures, sensational stories, and the sight of blood, accidents, or other events which appeal strongly to their emotions.

Curative. Beyond the avoidance of all sources of brain irritation or excitements, such as those mentioned in the preceding paragraphs, and paying attention to the same details that are indicated for the prophylaxis, little can be done in the way of treatment, except to protect the child from the various dangers which are incidental to walking about in an unconscious condition. The child should not be allowed to sleep in a room by himself, but should always be in a room occupied by a second person who is not a heavy sleeper and who has a full sense of responsibility.

I have never myself seen any advantage from the popular

method of fixing a reel or some other object over the prominence of the lumbar spine to prevent the child from sleeping on his back, but there may be some practical advantage in tethering the child to the bed by some such sort of restraining belt as is used for preventing babies from falling out of perambulators.

Drug Treatment. The drug treatment of this condition is unsatisfactory, and in any case cannot be continued for an indefinite time, but on occasions of unusual excitement, when repetitions of the habit may be expected, the central nervous system should be quietened down by full doses of bromide. Small doses are useless for this purpose, and I do not recommend the use of luminal or other barbituric drugs.

DISORDERS OF CONDUCT

The list of disorders of conduct commonly exhibited by children under 5 years of age, and which may be the early indications of mental deficiency, is a long one, and includes stealing, lying, spitefulness, dirtiness, bestiality, fits of temper, refusal to take food, and uncontrolled crying.

Such vagaries of behaviour may be symptomatic of bad management, or they may represent manifestations of a disordered mental state of organic or functional origin.

The treatment, however, of these conditions, with the possible exception of anorexia nervosa, scarcely comes within the scope of this work, and it demands a full knowledge of child psychology, which is most suitably provided at one of the Child Guidance Clinics which are doing such useful work at the present time.

Anorexia Nervosa

Refusal to take food, or self-imposed starvation, is a very common symptom in children under 5 years of age. The great majority of " only " children suffer from it in some degree owing to the solicitude for their welfare displayed by parents and nurses, and the undivided attention such children receive. The majority of parents as well as nurses have very faulty ideas with regard to the amount of food that is necessary to maintain normal nutrition. The symptoms generally arise from the child being persuaded, cajoled, or even forced to take food at a time when he evinces no inclination to do so. The trouble usually commences at or about the time of first dentition, or when weaning is in progress, much earlier in fact than is usually suspected. At such times the infant often loses his appetite, and displays great aversion to his bottle, or food in any form. If this natural and protective

instinct is not humoured and the infant is forced to take food when he does not want it, he very readily falls into a condition of " food shyness," which paves the way for the major condition of " Anorexia Nervosa," which as a rule reaches its acme between the 2nd and 5th years of life. If this neurosis is not judiciously handled it develops later into a very intractable habit which causes much anxiety, and is usually regarded as symptomatic of some serious form of indigestion, especially when the child reaches the stage of vomiting when he is forced to take food, or of heaving at the sight of a meal.

Treatment.

Prophylactic. If appropriate precautionary measures are taken at a sufficiently early date, the true condition of anorexia nervosa need never develop. Too much attention must not be concentrated on the child, or what he eats, especially during periods of dentition, or when from any other cause his appetite temporarily fails. His inclinations should be humoured, and if the child prefers it he should be allowed to take his food cold rather than at the usual temperatures. Babies with hot gums find it very soothing to take cold food substances into their mouths. Nurses and mothers should also make a study of the quantities of food physiologically required by children of different ages; as a rule they have a very exaggerated view of the amounts required. I generally explain this matter to parents by saying—" Your own weight is probably about 10 st. while that of the child is about 2 st. You require at least three times as much as your child. If you divide the quantity of food you consider necessary for yourself into three equal parts and give one of them to the child, that will be about the correct amount." This quantity differs very materially from the amounts most children are expected to take.

Curative. The cure of a fully established case of anorexia nervosa is difficult. It involves the employment of psychological principles which apply to the parents or the nurse, quite as much as to the child. The guardians of such children must be convinced in the first place that there is nothing organically wrong with the child himself, except that he is dominated by an imperative obsession. The child must be treated by suggestion, and his obstinacy ignored. One of the best and quickest ways of effecting a cure is to meet negativism by negativism, and to substitute obligatory starvation for that which is voluntarily imposed, in other words, not to allow the child to have food even when he wants it, but to submit him to enforced and imposed starvation until he becomes really hungry. He will then most probably

try to steal food if he cannot get it by other means. This method of paying out the child in his own coin, measure for measure, is most effective, and I have had many instances of its complete efficacy. As a matter of fact, however, very few parents have the courage to continue the treatment long enough to be effective.

To meet the majority of cases, the best way of breaking the habit of anorexia nervosa is to send the child to a good residential nursery school where the mass suggestion of a number of healthy and hungry children soon exorcises the evil spirit.

The treatment however must be continued long after a cure has apparently been accomplished, otherwise there will be recidivist tendencies.

DISORDERS OF SPEECH

This class of neurosis includes stuttering, stammering, lalling, lisping, echolalia, idioglossia, deaf-mutism, word blindness, or word deafness. Some of these conditions, like lisping and stammering, are more or less nervous habits acquired by neurotic children by mimicry, imitation, or accident, while word blindness or deafness and deaf-mutism are generally congenital defects of an organic nature, and idioglossia and echolalia sometimes presage definite mental defect.

Very few speech abnormalities are due to actual anatomical defects in the speech apparatus, such as palatal defects, hare-lip, or tongue-tie, although quite a number of them are attributed popularly to some such cause. They are due for the most part to central causes and inco-ordination of the neuro-muscular mechanisms by which speech is effected, and most of them can be cured, if they can be cured at all, by psychological and re-educational methods. The treatment however of these conditions does not come within the scope of this work.

DISORDERS OF VOLUNTARY MOVEMENT

(*Neuro-muscular Inco-ordinations*)

The list of these disorders includes left-handedness, ambidexterity, mirror writing, and certain athetoid or choreform movements, including St. Vitus' dance, or Sydenham's chorea.

Left-Handedness

This condition as well as that of ambidexterity is fairly common, and is definitely of familial origin. It occurs in families, in which other members suffer from stammering, chorea, or allied affections.

Treatment. The problem often arises as to whether children who show indications of being left-handed or ambidextrous should be taught to use their right hand. There are indeed certain cases in which children become ambidextrous or even left-handed by accident or force of habit, without possessing any hereditary or familial predisposition to such perversions. In such cases if re-education can be begun at a sufficiently early age, that is to say, before the idiosyncrasy has become a very inveterate habit, it may be comparatively easy to induce the child to use his right hand in preference to his left, without any concomitant injury to his mental equilibrium, but in cases in which there is known to be a familial predisposition, or when the child is nervous or neurotically disposed, it is better to allow him to follow his own inclination as to which hand to use, since otherwise his " nervousness " may be made worse and its manifestations break out in other directions, as for instance, into that of stammering.

Mirror Writing

Mirror writing appears to be an exaggerated form of a tendency which is not altogether unusual in normal children, namely that of drawing indiscriminately upside-down or right side up. This tendency, if it is only a tendency, is soon lost in the case of normal children, but in those who are mentally defective it may tend to become perpetuated as a fixed and persistent habit.

Treatment. This condition requires no prophylactic or curative form of treatment, beyond that of paying no attention to the idiosyncrasy, and making the child concentrate on writing or drawing in the conventional manner.

Choreic Movements

Children often acquire spasmodic muscular movements, or ties, which closely resemble those pathognomonic of Sydenham's chorea, and which are often mistaken for it. These athetoid or choreic movements sometimes have a definite organic or syphilitic basis. On the other hand, they may be acquired by mimicry or accident by neurotic children.

The diagnosis of the cause is important from the point of view of treatment, as those movements acquired by mimicry, or due to organic disease do not yield to treatment in the same gratifying manner as Sydenham's chorea. If such movements occur in children under 4 years of age, and are of a fixed nature not affecting volitional movements, they are almost certainly not Sydenham's variety, and must be treated on methods which are appropriate to the cause.

Sydenham's Chorea

(Rheumatic Chorea)

Sydenham's chorea is usually regarded as a cerebral expression of the rheumatic state, and as such might be better included among the rest of the rheumatic manifestations, but its predilection for nervous children, and the similarity of its manifestations with the non-rheumatic choreiform movements described in the preceding section, and the fact that definite cases of Sydenham's chorea occasionally leave behind them an aftermath of equally definite habit spasms, has induced me to include it in this group of functional neuroses.

The differential diagnosis of Sydenham's chorea from habit spasms and other choreiform movements due to organic or other affections of the central nervous system, is assisted by the fact that chorea interferes with the performance of voluntary movements, making them clumsy and jerky when brought into play.

An attack of true chorea seldom lasts longer than 6 weeks, if subjected to ordinary measures of treatment, but there may be relapses or residual symptoms. It seldom affects children under 4 years of age. Habit spasms on the other hand may develop at any age, and take place independently of voluntary movements. Choreiform movements which last longer than 3 months are very improbably true chorea.

Treatment.

Prophylactic. Prevention must be directed to two factors—first, the underlying state of " nervousness " in the child, in other words the soil ; and second, the rheumatic poison itself, which represents the seed. It must however be remembered that the chronic infection which constitutes the rheumatic state is itself a prolific source of a general nervousness in children, which generally shows itself by indefinite pre-choreic symptoms long before the specific symptoms of chorea appear.

As far as anti-rheumatic prophylaxis is concerned, the details of treatment will be found in the section on Rheumatism (page 444), and consist for the most part in searching for definite foci of streptococcal infection, such as tonsillitis, sinusitis, otitis media, or carious teeth. Chronic catarrhs of the alimentary tract are in my view frequent precursors of definite rheumatic states.

The predisposing condition of nervousness in the child demands the exercise of all the precautionary measures that have already been enumerated in the preceding paragraphs as essential for the treatment of such children, that is to say, the child should

live a sheltered and uneventful life, free from emotional shocks, psychological disturbances, nerve strain of all sorts, and other events which interfere with rest and sleep. Irritating influences of incompatible companionship are factors which must be constantly borne in mind.

As in the case of all other forms of nervousness in children, intestinal toxæmia plays, I believe, a most important part as a predisposing factor, and must be treated on appropriate lines.

Curative. The treatment consists in keeping the patient in bed until 14 days after the acute symptoms have subsided. The child should be kept amused, but not allowed to become excited by the presence of strangers. There is no need if the case is being treated in hospital to screen him off from the view of other patients, unless there is any particularly disturbing event taking place in the ward. The child should be warmly clothed in Chilprufe pyjama suiting, and should be kept in a room to which the sun has access, and of which the temperature is not higher than 64° F. by day, nor 58° F. by night.

As far as diet is concerned, it is generally recommended that the patient should be generously fed. If by this term excessive feeding is meant, this is not in accordance with my views. The quantity should be co-ordinated to the requirements, which are about those of a normal child taking moderate exercise, that is to say, rather more than that suitable for a child at complete rest in bed, in view of the fact that a choreic patient indulges in a considerable amount of involuntary movement although completely immobilized. The diet should consist of a moderate quantity of milk, with plenty of cereals, fruit, and vegetables, and with only a modicum of meat, fish, or eggs. The food should be made attractive and as varied as possible.

In all cases care should be taken that the patient does not fall out of bed, or incur skin bruises or other injuries owing to the involuntary movements. Hot packs are sometimes indicated to control the restlessness and promote sleep in serious cases.

Drug Treatment. The drug treatment of chorea is mainly that of the parent condition, namely, rheumatism. I strongly advise the giving of a morning draught of some effervescent saline, such as Eno's Fruit Salt, or Knutnow's Effervescent Powder during the whole time the child is in bed. The treatment should also provide full doses of salicylate of sodium combined with a suitable alkali. I believe in the majority of cases this combination is better than giving aspirin without bicarbonate of sodium. For a child between 4 and 5 years of age not less than 5 grains of each of the above drugs should be given daily. In addition occasional doses

of phenacetin (1 gr.) and citrate of caffeine (½ gr.) may be given in cases in which there are exacerbations of the symptoms. I am not an advocate of the use of adalin (Bayer), chloral, chloretone, luminal, or any other drugs of the barbituric group, which are commonly given to choreic patients. If, however, maniacal or cerebral symptoms supervene it may be necessary to give for a time some such hypnotic as chloral or luminal by the mouth, or hydrochloride of hyoscine by subcutaneous or intravenous injection. Arsenic should not be given during the acute stages, but should be reserved for convalescence.

Special Methods of Treatment. *Nirvanol Treatment.* This treatment consists in giving nirvanol, which is one of the barbituric group of hypnotics, namely, phenylethylhydantoin, in sufficiently large doses to cause toxic symptoms with fever, rash, and eosinophilia, a result which is supposed to cause a revulsive or antagonistic reaction which is beneficial to the choreic condition. I have never liked this method, and regard it as unreliable and dangerous, and for that reason I do not supply further particulars as to dosage, etc.

Typhoid Vaccine Treatment. This treatment consists in giving a daily intravenous injection of typhoid-para-typhoid vaccine, starting with 200 million bacteria and increasing the dose, if necessary, until a febrile reaction of 104° F. is obtained. It is usually necessary to continue the injections for 6 or 8 successive days.

Warren's Sweat-Box Therapy. This treatment is very much freer from risk than either of the two foregoing, and probably quite as efficacious. It consists in producing hyper-pyrexia by placing the patient in a cabinet or sweat-box which is heated by electric-light bulbs fitted over the bed, and enclosing the child completely except for his head. The exposure should continue until the rectal temperature reaches 105·8° F. To avoid risk the rectal temperature should be registered every 10 minutes, and the child should be allowed to drink as much cold water as he pleases.

Treatment of the Later Stages. This treatment presents considerable difficulty, for after the subsidence of the acute symptoms the child quite commonly passes into a condition of residual chorea, in which there are symptoms of inco-ordination of movement and muscular debility. This condition must be treated on general convalescent lines, with massage, re-education, and appropriate feeding. The specific treatment of the underlying rheumatic condition is unnecessary, but naturally latent foci of

streptococci in the tonsils and elsewhere must be carefully sought for, and, if found, surgically treated.

Complications. The main complication of chorea is rheumatic involvement of the heart, either in the form of valvular disease or pericarditis. A careful watch must be kept for such developments, and if they occur they must be treated on the lines appropriate to the condition—that is to say, by prolonged recumbency in bed, and by anti-rheumatic therapeusis.

Hysteria

Hysteria certainly occurs in quite young children, even in infants, but at what point hysteria ends, and at what point insanity commences, is often very difficult to define. The ordinary manifestations of hysteria in young children may take the form of emotional outbursts of laughter or crying, or temporary periods of paralysis, deafness, blindness, or aphonia.

Treatment. *Prophylactic.* This is in my opinion most important, for I am sure I have seen many cases of hysteria in young children which would have developed into definite degrees of mental derangement had not the exciting cause been recognized and removed. On the other hand, I feel equally sure that in certain cases if the appropriate remedy had been applied, initial hysterical symptoms would not have culminated in definite states of mental defect. The cause, apart from the underlying hereditary tendency, is nearly always some incompatibility of personality of the parent, or nurse, combined with want of proper psychological understanding and general management.

Curative. A change in the entourage, and temporary removal to new scenes and environment, often effect a miraculous improvement. The general management of these cases is very much the same as that recommended for nervous children (page 547).

As regards drugs, these should include the administration of bromide, arsenic, and belladonna, in order to stabilize the central nervous system. In nine cases out of ten there is a complicating condition of intestinal toxæmia, which causes damage to the neuronic system by the circulation of toxins which have not been rendered inactive by the detoxicating functions of the liver. To correct this adverse factor it is necessary to employ methods to check intestinal decompositions and to encourage liver efficiency. For this purpose the diet should be as simple as possible, and contain a minimum of decomposable protein elements, in fact the case should be treated on the lines already advised for intestinal toxæmia (page 223).

Neurasthenia

Neurasthenic symptoms are quite common in children under 5 years of age, even among infants less than 1 year old, and include in the latter case backwardness in many of the voluntary muscular co-ordinations, such as those of standing, crawling, walking, etc., as well as symptoms of sleeplessness, crying, and troublesome dentition. In older children there is evidence of lack of energy, and want of interest in games and occupations which amuse normal children. There is also failure of concentration, liability to fatigue, and a general feeling of tiredness, with a tendency to sit in huddled-up positions in chairs, or curled up on sofas. Such children also stand in faulty positions, while lateral curvatures and flat feet are liable to develop.

On the psychological side there is irritability of temper, a tendency to weeping, and general moodiness.

The causes of neurasthenia are partly inborn, and partly acquired. The acquisition in its turn is generally dependent on some chronic infection, such as that of tuberculosis, sepsis, middle-ear disease, sinusitis, follicular tonsillitis, carious teeth, or catarrhal conditions of the bowel. Malnutritional states due to faulty feeding, especially with respect to the accessory factors, is very often the cause of the trouble.

Neurasthenic children often have bad appetites, muddy complexions, unpleasant breath, light-coloured and offensive stools, various irregularities of the bowels, and strong-smelling urine in fact the symptoms pathognomonic of intestinal toxæmia and failure of liver function.

Treatment.

Prophylactic. Infants who are well fed, whether naturally or artificially, seldom show early indications of neurasthenia, suggesting what a large part food plays in the etiology. Apart from feeding, however, other hygienic factors are concerned in the prophylaxis, as for instance, opportunities for exercising the muscles on an organized basis, such for example as those afforded by the Neumann-Neurode system, or the tonic influences of the graduated cold or shower bath, either with or without massage, all these are preventive measures which serve their purpose. For older children, in addition, it is essential to pay attention to the psychological aspects of the etiology, and to treat energetically in their incipient stages, such conditions as tuberculosis, sinus infections, naso-pharyngeal catarrhs, as well as intestinal and liver conditions.

Curative. Neurasthenic conditions, though easy to prevent, are

difficult to cure when once they have obtained a foothold. They demand special attention to the digestive system, for as already indicated, intestinal toxæmia is one of the most prolific causes of that damaged condition of the central nervous system which is an essential element of the neurasthenic state. It must be treated on the lines laid down in the paragraphs devoted to this subject (page 223), which include procedures for intestinal disinfection, limitation of protein foods, and the promotion of the detoxicating functions of the liver. I regard the patient administration of small doses of petroleum emulsion (semprolin for preference, page 696), either with or without creosote, after each meal, as far and away the best method of treating conditions of chronic intestinal intoxication. The daily administration of one triturette of mixed salts (page 696) the first thing in the morning on waking, combined with the juice of an orange, is an integral part of successful treatment. In most neurasthenic cases there is, I believe, evidence of some general demineralization of the tissues, which is compensated for by the giving of these combined salts. This especially applies to lack of calcium base, which shows itself by spasmophilic tendencies. Calcium can be conveniently supplied in the form of calcium glycerophosphate, or the proprietary article, Sanatogen, which is a casein preparation containing both the calcium and the glycerophosphate radicles.

Apart from these routine procedures, certain neurasthenic conditions are benefited by specific endocrine treatment, as for instance by thyroid extract in cases of hypo-thyroidism, or by adrenalin in cases of low blood pressure, which is a common symptom in neurasthenia.

MENTAL DEFICIENCY

The very large subject of Mental Deficiency will be treated shortly here, since its amenability to treatment depends almost entirely on eugenic measures and educational procedures, neither of which come within the scope of this work.

Mental deficiency is a condition of arrested or incomplete development of mind, existing before the age of 18 years, whether arising from inherent and hereditary causes, or acquired by disease or injury. If the condition pre-exists before the development of a normal state of mind, it is called amentia. If acquired after the mind has attained some degree of normal function, if in fact it is a degenerative process, and represents loss of sanity, it is entitled to the term dementia.

In children under 5 years of age disorders of mind mostly take the form of amentia. They may vary considerably in degree, and in order of seriousness may be classified as (1) Feeble-mindedness; (2) Imbecility; and (3) Idiocy. These several degrees of mental defectiveness have been defined as follows:

Feeble-minded children are those in whose case there exists mental defectiveness, which though not amounting to imbecility, is yet so pronounced as to require care, supervision, and control for the protection of those affected, or for the protection of others. Such children are permanently incapable by reason of their infirmity of receiving proper benefit from the instruction given in ordinary schools.

Imbeciles are defined as persons in whose case there exists mental defectiveness, which though not amounting to idiocy, is yet so pronounced as to render them incapable of managing themselves or their affairs, or of being taught to do so.

Idiots are defined as children in whose case there exists mental defectiveness of such a degree that they are incapable of protecting themselves against common physical dangers, and incapable of being taught to do so.

Amentia is called primary when there is a definite neuropathic inheritance and the condition is due to some germinal defect, and this class constitutes about 80 per cent of the total number of Ments. The remaining 20 per cent are accounted for by cases which are due to somatic influences on the embryo, fœtus, or infant, and include those of trauma, inflammation, encephalitis, hydrocephalus, syphilis, epilepsy, cretinism, as well as endocrine and nutritional injuries.

The causes of amentia have been classified by Dr. A. F. Tredgold in accordance with the following plan:

PRIMARY AMENTIA DUE TO GERM VARIATION

Factors indicative of, or producing, a Variation of the Germ Plasm

1. Neuropathic inheritance.
2. Alcoholism.
3. Tuberculosis.
4. Syphilis.
5. Consanguinity.

} of parent or parents.

6. Advanced age of Parents.

SECONDARY AMENTIA DUE TO SOMATIC MODIFICATION

Factors acting directly upon the Offspring

(*a*) Before Birth
1. Abnormal conditions of the *Mother* during Pregnancy (1) Mental, (2) Physical.
2. Injuries, etc., to the Fœtus.

(*b*) During Birth
1. Abnormalities of Labour.
2. Primogeniture.
3. Premature Birth.

(*c*) After Birth
1. Traumatic.
2. Toxic.
3. Convulsive.
4. Nutritional.

These distinctions are important from the point of view of prophylaxis.

The diagnosis of mental deficiency in infants is often very difficult, and none too easy in the case of children between 1 and 5 years of age. It is of course made easier when it is accompanied by anatomical deformities, or by stigmata of degeneration which enable one to give a name to the condition, such as mongolism, microcephaly, hydrocephaly, oxycephaly, hypertelorism, nævoid amentia, and amaurotic idiocy. Mental deficiency may however be suspected in children whose outward appearance is normal, when they show during infancy some marked perversion of conduct or delay in learning how to perform the ordinary organic functions of life, such as those of sucking, swallowing, defæcation, micturition, holding up the head, sitting up, and other simple muscular movements.

In normal infants both the motor and the sensory functions, as well as the early gleams of intelligence, exfoliate in a certain definite order, and at more or less definite age periods. Infants should be able to grasp objects, fix their eyes and attention on objects, recognize persons, hold up their heads, sit up, crawl, walk, smile, frown, and make intelligible utterances by certain specific dates. If an infant cannot recognize its own mother at 6 months, hold its bottle at 7 months, sit up at 8 months, stand at 14 months, or say simple words like " Mum-Mum " and " Dad-Dad " before 16 months, there is something radically wrong with its nervous organization, and some degree of mental defect may be expected. Too much reliance however must not be imposed on any one single symptom, or combinations of a few symptoms to prove or disprove mental defect. It is when there is delay and abnormality in the performance of a number of the functional muscular co-ordinations that suspicions of mental defect are justified.

It is at times difficult to distinguish between delayed mentality in infants or children handicapped by blindness, deafness, or paralytic affections such as spastic paraplegia, and definite degrees of amentia. In my capacity of Consulting Physician to the National Institute for the Blind, I have to examine a large number of blind infants. The medical reports which come with

these children indicate how difficult it is for the practitioner to recognize early indications of mental defect. The remark usually appears in the case-paper of children under 1 year of age that they are too young for a statement to be made as to whether they are mentally deficient or not. Although infants of this age are too young to apply the ordinary tests, such as the Binet-Simon or the Merrill-Palmer, or Burt's or Terman's modification of them, nevertheless their degree of mentality can to some extent be gauged by reference to the time of development of the above-mentioned muscular co-ordinations.

The treatment of the different types of mental deficiency not included in those specifically mentioned below must be conducted on the general lines indicated by the etiological circumstances. Very little however can be done by way of prophylaxis, and even less in the way of remedial treatment.

The educational and disciplinary training of mentally defective children is of a very special kind, and cannot be described here, but it well repays any trouble expended on it. For the sake of other members of the family it is very advisable that mentally defective children should be removed from the home environment and admitted to some special home or institution which is equipped for this difficult kind of treatment. For those who cannot be provided with institutional treatment of this kind, the main objective in treatment is to secure blind and implicit obedience to orders, and the acquisition of good habits of personal cleanliness, tidiness, and control of the functions of the bladder and bowel. Play conducted on the Montessori or other Kindergarten lines is a good means of providing education.

Mongolism

It is often difficult in cases of mongolism, in which the physical stigmata of the condition are well marked, to formulate a reliable prognosis as regards future mentality. Mongolian babies do not by any means always develop into mongolian idiots, or even into conditions of feeble-mindedness. Twenty per cent or more of them attain to quite a reasonable standard of intelligence. It is therefore a matter of some importance to be in a position to reassure the parents with respect to the mental prospects of such children, and to assess the prognosis by the application of simple intelligence tests such as are given in the general account of mental deficiency (page 579).

The cause of mongolism cannot be the age of the mother, the position of the child in the family, the ill-health of the mother, endocrine defects, or many of the other etiological factors to

which it has been attributed. It is clearly due to some germinal defect, affecting the particular ovum or spermatozoon which has given rise to the child in question, because there are many cases on record, I have seen no less than three myself, in which one twin has been a mongol, while the other one has been perfectly normal. It is impossible to believe that any of the above suggested etiological factors could affect one twin without affecting the other one at the same time. Why one impregnated ovum, however, should be sufficiently degenerate to lead to mongolism, while others which have preceded it or followed it are perfectly normal, is difficult to explain, but the central fact remains that mongolism cannot be anything else than a germinal defect, and cannot be prevented by any prophylactic means at present known to science. Dr. F. G. Cruickshank has hazarded the suggestion that mongolism is a throw-back to a previous ancestral type, and that it occurs in classes in which there is an infusion of mongolian blood. It does not seem to me to be necessary to resort to this explanation. It is quite sufficient to assume that the ovum or spermatozoon is degenerate and may therefore easily revert to a more primitive type of development, not necessarily mongolian.

Treatment.

Prophylactic. There is no prophylactic treatment as far as the main condition of mongolism is concerned, but as regards prevention of some of the developments and complications many obvious procedures are open to us, and these are referred to in the following section which deals with remedial measures.

Curative. Mongols are undoubtedly difficult to rear. They are highly susceptible to all forms of infective disease, especially to pneumonia and other affections of the respiratory system. Mongols almost invariably suffer from what is supposed to be a condition of enlarged tonsils and adenoids, and very rarely escape operation. I have known cases of mongolism in which the operation for the removal of adenoids has been repeated two or three times in a futile attempt to provide sufficient air space in the posterior nares, which are characteristically narrow and contracted. In the case of mongols the routine douching of the nose (as described on page 231) is a prophylactic measure of some value in the prevention of the development of catarrhal conditions of the naso-pharynx.

The general treatment consists in careful feeding, breast feeding for preference, and protection against infection. Attention must be paid to the circulation, especially in those cases in which there is any concomitant defect of the heart. Atony of the bowel, umbilical hernia, and constipation are all frequent complications

and require special attention. To prevent a general enlargement and ballooning of the intestines I am convinced that the generous administration of the vitamin B complex from birth onwards is a most reliable prophylactic. I generally prescribe it in the form of some yeast preparation, such as Yestamin (page 708), which should be given to the extent of 15 grains daily, or the vitamin may also be given in the form of Bemax or Marmite. As a prophylactic against catarrhal and other infections, vitamin A and vitamin C should be given in full amount, as also should vitamin D to prevent any of the exceedingly probable rickety developments.

Umbilical hernia requires early treatment by the application to the navel of a double strip of plaster between the layers of which is placed a large flat button, or counter. This should be worn continuously for several months, and renewed every 14 days.

Specific Treatment. Although I am sure that mongolism is not primarily an endocrine defect, as is so often believed, there can be no question that it is greatly improved by endocrine treatment. It is generally advised to give a mixture of the extracts of the thyroid, pituitary, thymus, supra-renal, and pineal glands on the " hit or miss " principle that if one fails one of the others will probably reach the target. For many years past I have had such success with the giving of thyroid and pituitary preparations, alone, that I now make no attempt to grapple with the difficult problem of regulating the thymus-suprarenal-pineal dosage. I have had the opportunity of following the progress of one or two cases over long periods of time—one of them as long as 20 years. When such cases are treated during the whole period of active growth by pituitary and thyroid the success is sometimes so great that at the end of the time it is extremely difficult to believe that those patients could ever have been definite cases of mongolism when they were infants. The dosage requires to be regulated and supervised, but I have generally found that $\frac{1}{6}$ gr. of thyroideum siccum and 2 gr. of pituitary (anterior lobe), given twice daily is sufficient.

Cretinism

This condition which is due to deficiency or absence of the thyroid secretion can, if taken in time, be cured by the artificial administration of thyroideum siccum which is referred to under Diseases of the Thyroid (page 359). For that reason it will not be dealt with in detail here. One of the chief matters of importance, however, in connection with the treatment of cretinism is to be able to distinguish it from the superficially similar condition

of mongolism. I have seen the two conditions frequently confused. For those who do not feel competent to draw the distinction for themselves, I advise reference to Dr. A. F. Tredgold's Table of the Differential Diagnosis, given in his book, "Mental Deficiency," 5th edition, page 225. I would say that cretinism is practically never capable of diagnosis at the time of birth, whereas mongolism should never fail to be identified at this stage; in mongolism the infant is born with all his imperfections on his head; in cretinism they are slowly acquired after birth.

CHAPTER XVI

DISEASES OF THE SKELETAL SYSTEM AND JOINTS

Osteogenesis Imperfecta

The cause of this disease is unknown, but it is often hereditary and familial in type. There are four symptoms which if found in combination make the diagnosis practically certain : they are :

1. Multiple fractures, ante-natal, as well as post-natal.
2. Blue sclerotics.
3. Deafness.
4. The presence of a peculiar angular projection or ridge of bone running round the skull just above the level of the pinna of the ear.

The blood calcium is variable in quantity and the blood phosphatase is normal.

Treatment. Although treatment by means of vitamin D, calcium, thyroid, thymus, and heliotherapy, is quite rational in cases of fragilitas ossium of known cause, they are supposed to be of little or no use in genuine cases of idiopathic osteogenesis imperfecta. Nevertheless, I have myself seen cases of the disease in which there could be no reasonable doubt as to the diagnosis, and which have improved rapidly on intensive anti-rachitic treatment, combined with massage and physical exercises.

Although a certain proportion of cases fail to survive birth, or die shortly afterwards, quite a large number recover almost completely.

The surgical treatment of the fractures by splinting, or other means, is in the case of young infants not only useless, but actually harmful, by the irritating and irksome restraint it imposes on voluntary movements. In infants under 3 months of age the osseous fragments unite readily enough without deformity, if they are left alone, and if the osteogenetic processes are encouraged by the same means that are found of practical value in ordinary cases of rickets. Some degree of movement seems to encourage the throwing out of callus, which is always deficient in cases of osteogenesis imperfecta. In older children in whom bony growth

is slow and less active, the fractures may require splinting, and it is particularly important, as Fairbanks points out, that the alignment of the fractured bones should be correct, otherwise additional fractures will occur for obvious mechanical reasons.

Marble Bone

(Osteosclerosis fragilis generalizata; Osteopetrosis; Infantile Osteosclerosis; Albers-Schonberg's Disease)

This is a progressive degeneration and sclerosis of bone, quite possibly of parathyroid origin. It is congenital, and familial in type, and in addition to the fragility of bone which is invariably present, there are nearly always anæmia, and other constitutional symptoms, with enlargement of the liver, spleen, and lymphatic glands. The bones show a characteristic radiological appearance in which there is a progressive sclerosis at the expense of the medullary cavity and cancellous tissue. This obliteration of the blood-forming areas in the medullary portions of the bone leads to a definite aplastic anæmia, and secondary enlargement of the liver, spleen, and lymphatics, while the deposition of dense bone at the base of the skull may cause pressure on the pituitary body and cranial nerves, and thus lead to a variety of symptoms.

Treatment. Beyond the symptomatic treatment of the anæmia by iron or blood transfusions, there is little that can be done in the way of treatment, although the association between this disease and disordered parathyroid function (hyperparathyroidism, page **362**) must not be lost sight of, and the possibility of effecting a cure through the removal of part of the parathyroid system.

Achondroplasia

(Chondro-dystrophia fœtalis; Micromelia)

This is a congenital and familial disease, which is hereditary in the male line, a fact which is explicable on the ground that female achondroplasics, owing to pelvic deformity, cannot bear a living child without the intervention of Cæsarean section. Among animals, dachshunds, bulldogs, pug-dogs, Dandie Dinmonts, and Dexter cows, are examples of the same disease, and they all breed true.

The cause is definitely germinal, but it may be due to some pituitary defect which is hereditary. It has no connection whatsoever with syphilis, tuberculosis, or rickets.

The main characteristics of the disease are a shortening of the long bones, especially of the proximal segments, upper arm and

thigh. The head is large and brachycephalic, the base of the nose is depressed. There is always considerable lordosis when the child begins to walk, and there is a wobbly gait, owing to some degree of *coxa vera*. The radiographic picture is definite and characteristic.

Treatment. There is no treatment for this genetic condition, and it needs none, for the victims of it are generally strong and intelligent, although as babies they are sometimes difficult to rear, and require special precautions in the feeding and general management.

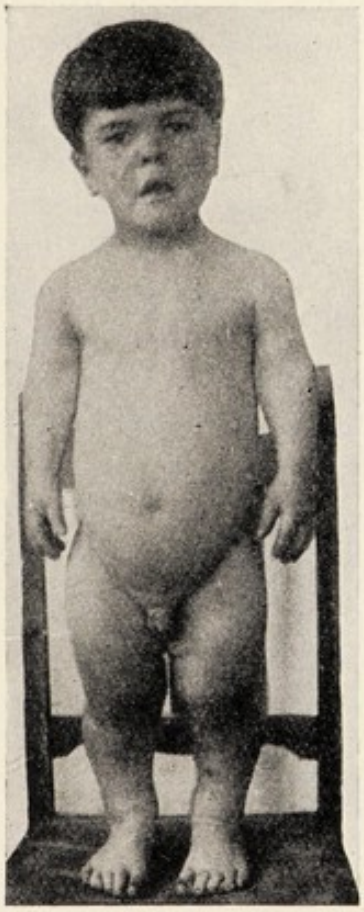


FIG. 23.—Achondroplasia in a boy aged 8.

(By permission of Mr. H. A. T. Fairbank.)

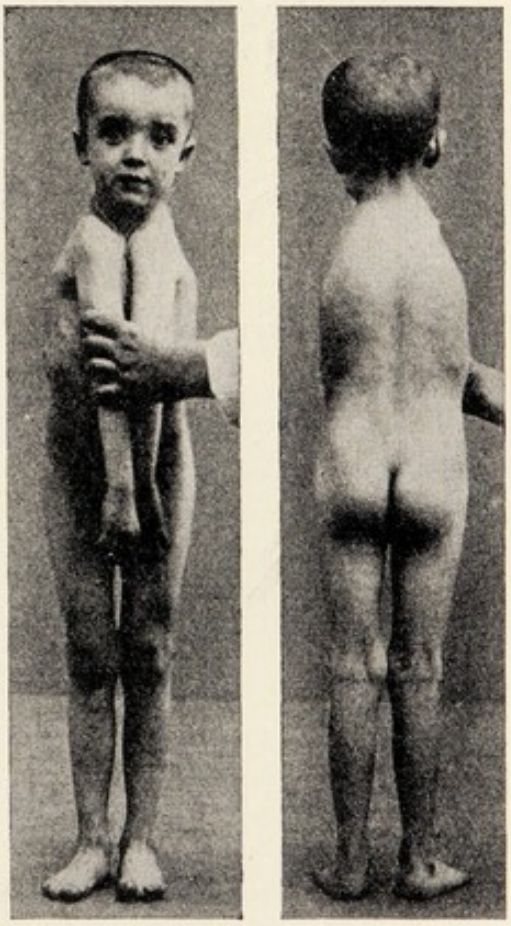


FIG. 24.—Boy with Cleido-Cranial Dysostosis.

(By permission of Mr. H. A. T. Fairbank.)

Cleido-Cranial Dysostosis

This condition, which is congenital, and often hereditary, is primarily a genetic defect which influences the osseous development of the clavicles, which in part, or in whole, are deficient. Although the sternal end of the bone is the one most often affected, the middle portion is frequently involved, and occasionally the acromial segment also.

There is an associated defect in the development of the muscles attached to the bone. There are usually, but not always, concomitant defects of the cranial bones, a fact which is implied in the above title, but there are also at times associated defects in other bones, with the general result that the victims of the disease are short in stature, with characteristic physiognomy and general appearance.

The defect in the clavicles is such that the shoulders can be made to touch in the central line under the chin with the exercise of comparatively little force. This disease is in some respects the antithesis of achondroplasia, in that in the latter disease the bones originating from cartilage are the ones affected, whereas in cleido-cranial dysostosis it is the membranous bones that are involved.

Treatment. There is no known treatment for this disease, either prophylactic, or remedial.

Oxycephaly

(Tower Skull ; Steeple Skull ; Acrocephaly)



Fig. 25.—Oxycephaly in an infant.

This is another congenital deformity of the skull : it is at times associated with syndactyly, or with other malformations of the

extremities. The condition is characterized by premature synostosis of the cranial bones. The sutures are in fact non-existent, and as a result the top of the skull is forced up in a dome-like formation *pari passu* with the growth of the brain. In contra-distinction to what occurs in hypertelorism, the great wings of the sphenoid bone are over-developed, displacing the temporal bone laterally, and causing the brachycephalic condition. The orbits are shallow, with marked exophthalmos, which may finally lead to dislocation of the eyeballs.

There is always some degree of mental defect, but there is no treatment, either prophylactic or remedial.

Scaphocephaly

In this congenital deformity of the skull, the latter is elongated rather than brachycephalic. Like oxycephaly, the deformity increases with the growth of the brain, but instead of a premature synostosis resulting, as in the case of the latter, the longitudinal suture remains widely open, and through it projects a diverticulum of the membranes which cover the brain, and this produces a keel-shaped crown extending the whole length of the head. In this condition the greater wings of the sphenoid are under-developed as in hypertelorism, and consequently there is no lateral bulging of the temples as in oxycephaly. The head appears definitely narrow. The orbits are not shallow, and there is no exophthalmos. There is no treatment, either prophylactic or curative for this condition.

Hypertelorism

(ὑπέρ too much : τῆλε apart : ὁρίζω to separate)

As the above name signifies, there is in this condition an excessive separation of the eyes, and a great increase in the width of the bridge of the nose, both of which cause a very characteristic facial appearance. The deformity is due to under-development of the greater wings of the sphenoid bone, and concomitant over-development of the lesser wings. This results in a separation, and anterior displacement of the two halves of the frontal bone, and the two halves of the nasal bone. Between the latter an accessory bone is usually interpolated. The skull as a whole is brachycephalic, and the occiput flattened. There is usually some mental defect, and there is no treatment, either prophylactic or curative.



FIG. 26.—Hypertelorism.
(By permission from Garrod, Ballen, Thursfield and Paterson.)

Congenital Encephalocele

These tumours are not frequently met with, and when they are, they should always be referred to a surgeon, since if they are amenable to treatment at all, the latter is purely of a surgical nature.

Acquired Encephalocele

Fig. 27 shows an acquired encephalocele in a baby 5 months old, which occurred as the result of a decompression operation in a new-born infant in whom a cerebral hæmorrhage had occurred, owing to obstetric trauma. A large piece of the left parietal bone was removed by trephining, and the opening thus produced allowed the prolapse of a considerable cerebral hernia.

The immediate pressure symptoms were relieved, but the child subsequently developed symptoms of a slight right-sided hemiplegia, and epilepsy : she is alive, however, and 10 years of age.

The result of this operation proves the feasibility of operating on cases of obstetric hæmorrhage of this kind, if the site of the hæmorrhage can be diagnosed, but it also suggests the advisability of replacing the bone removed, or doing a flap operation, so as to avoid complete severance of the bone, and interference with the circulation and subsequent union.



FIG. 27.—Acquired Encephalocele, the result of trephining for Cerebral Hæmorrhage (Birth Injury).

Spina Bifida

This is an exceedingly common malformation. It may occur independently, or in combination with hydrocephalus. The chief point of interest in connection with it to the practitioner, is whether the tumours are, or are not, operable. This question must be settled by the size of the tumour, the extent of the deficiency in the spinal laminæ, the presence or absence of an associated hydrocephalus, and the extent to which the nerve fibres of the cauda equina are involved in the sac. With any evidence of paralysis or nerve involvement surgical interference is hopeless. In cases in which operation is useless, nothing can be done beyond protecting the sac from ulceration and rupture by the application of a celluloid or poroplastic cap, which is designed to fit the tumour and is held in position by rubber or webbing straps encircling the abdomen. The pressure can be adjusted from time to time by padding within the cap, and if continuously applied, it often leads to a marked decrease in the size of the tumour, and a great improvement in the condition of the skin covering the sac, thus promoting a chance of successful operation.

The initial tension within the sac is a factor of considerable importance, not only as regards the prospect of a reduction in size, and a favourable prognosis for operation, but also as regards the possible development of hydrocephalus. The dehydration method which is described in connection with hydrocephalus (see page 534) is also applicable in cases of spina bifida, and is valuable

for the reduction in the tension of the cerebro-spinal fluid. On humanitarian grounds, if the prospects of operative interference are not distinctly favourable, it is better to pursue a policy of inactivity and non-interference.

Spina Bifida Occulta.

In this condition there is no external tumour, but merely a failure of the laminæ of one, or at most two, vertebræ to unite. The site of the abnormality is sometimes indicated by a patch of hairy pigmentation, by nævus formation, or by a nævo-lipoma. Usually however there are no symptoms, and the condition requires no treatment. The extent of the deficiency in the laminæ can best be revealed by X-rays.

Web-neck or Klippel-Feil's Disease

This rare disease [1] has certain superficial similarities with congenital torticolis, only in the case of Klippel-Feil's Disease there



FIG. 28.—Web-neck. Showing puckering of skin between mastoid and acromial processes.

is symmetrical shortening of the muscles and soft parts on both sides of the neck. The shortening of the neck which results

[1] PRITCHARD, ERIC, "Congenital Short-neck or Klippel Feil's Disease," *Proc. Royal Soc. Med. Section Dis. Child.*, October, 1928, p. 130.

gives an appearance as if the head were sunk into the thorax. The cervical vertebræ are very irregular in shape. They are more or less fused together, with deficiency of the laminæ and enlargement of the transverse processes. When the head is extended, which can only be done with some difficulty, and after the application of some force, the skin and the superficial faciæ which connect the mastoid and acromial processes, are put on the stretch, giving a very definite appearance of webbing or puckering up of the skin, to which the condition owes its name of " Web-neck."

The cause of this deformity is not clear. It might well be explained on the grounds of a cramped position of the fœtus *in utero*, were it not for the fact that there are as a rule other developmental defects. In one of my cases [1] there was a cleft palate as well as a pre-auricular tubercle.

Treatment. The only possibility of cosmetic relief of this very unbecoming deformity lies in a plastic operation, such as has been described by Sir Harold Gillies.[2]

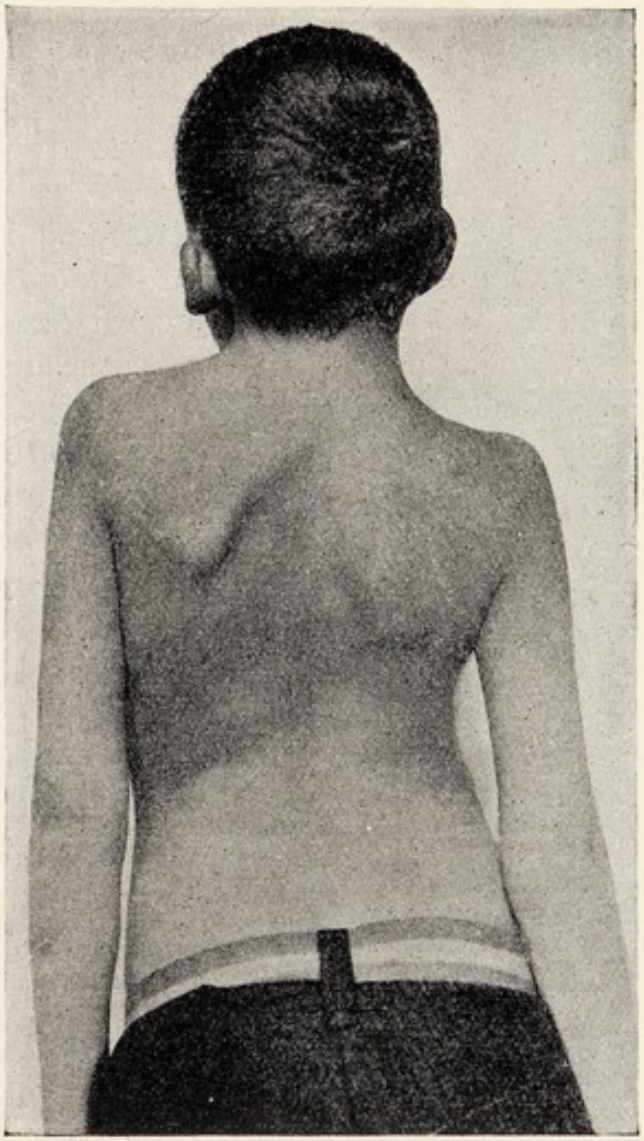


FIG. 29.—Congenital High Shoulder. (Sprengel's Shoulder.)
An example of the deformity in a boy 7 years old. (By permission from Mercer's " Orthopædic Surgery.")

Congenital Elevation of the Scapula

(Sprengel's Shoulder)

This rare condition is sometimes of familial type. It consists in an elevation of the scapula on one, and occasionally on both sides, so that the muscles uniting it to the skull and

[1] PRITCHARD, ERIC, " Congenital Web-neck or Klippel Feil's Disease," *Proc. Royal Soc. Med. Section Dis. Child.*, June, 1934, p. 1007.

[2] GILLIES, SIR H., " Congenital Web-neck or Klippel Feil's Disease," *Proc. Royal Soc. Med. Section Dis. Child.*, June, 1934, p. 1007.

cervical spine are shortened. The resulting disability is sometimes considerable, the main effect being shown by an inability to raise the arm above the head. This deformity appears to represent a reversion to some primitive type of shoulder girdle.

Treatment. The treatment is difficult and consists in the severance of any bony or fibrous connections which keep the scapula unduly immobilized to the spine, and in manipulative exercises for the purpose of stretching the muscles and soft parts which restrict movement.

DEFORMITIES OF THE THORAX

Funnel Chest

This very disfiguring deformity is often regarded as due to abnormal pressure exercised *in utero* on the sternum by the elbow or heel, but seeing that several cases have been reported in the same family, it is more probably due to some hereditary defect of a genetic character. The deformity consists in depression of the sternum at its costo-chondral attachments.



FIG. 30.—Funnel Chest.

Treatment. This is not very satisfactory, especially in the case of very young infants, but the condition is said to be capable of improvement by means of suction applied over the sternum. This can be done by placing a bell-jar over the sternum, with its edges embedded in a ring of Unna's zinc paste, and producing a vacuum in it by means of a pneumatic pump. This apparatus must be used regularly every day over a considerable period of time. Breathing exercises in which lateral expansion is prevented by an apparatus —exactly the reverse of that described for pigeon chest (see page 595) —and by which expansion in the antero-posterior diameter is encouraged, may improve the condition, but any breathing exercises in which lateral expansion is not prevented, are liable to do more harm than good.

Pigeon Chest

This condition is not usually included in the list of congenital deformities, but is regarded as a defect which is acquired in early childhood, owing to obstruction to the entry of air through the upper respiratory passages, or sometimes to an unduly soft condition of the ribs (rickets), especially in those cases which are complicated by a chronic cough. I have however seen so many cases in which there have been early indications of the deformity before the above causes could have been concerned in the etiology, that I am inclined to regard the deformity, at least in many cases, as due to some familial tendency of growth, and I have therefore included it along with funnel chest amongst the congenital deformities of the thorax.

My experience of cases of pigeon chest is that the condition is so generally regarded as incurable that no steps are taken to prevent the development of the deformity, or to apply curative treatment. As a matter of fact pigeon chest is such a very unbecoming deformity, especially in girls, and causes such very definite respiratory disabilities, that if anything can be done to prevent or cure it, it is well worth the trouble.

Treatment.

If the treatment is commenced early enough, it is quite possible to cure the deformity completely,[1] but the cure is slow and entails the wearing of an apparatus, perhaps for many months, or even years. The apparatus consists of two lateral springs, which apply pressure in the antero-posterior direction, on the sternum through the mediation of a padded breast-plate, and on the spine by a similar arrangement, and thus prevent expansion in this diameter, but allow free lateral excursions. The apparatus, after the child has got used to it, can be worn by night as well as by day, and especially is this necessary should the child develop a cough. It is by no means uncomfortable, and children often miss it when after a cure has been effected, they cease to wear it. It is very important that the apparatus should be well made, and that it be renewed when with the growth of the thorax it ceases to fit properly.[2] The apparatus in itself is not very expensive, but it usually requires renewal after 12 months' wear.

Deep breathing exercises, with the apparatus in position, greatly accelerate the cure, but breathing exercises without any

[1] *British Journal of Physical Medicine*, Oct., 1936, vol. ii, No. 6, p. 102.

[2] Although any surgical instrument-maker should be capable of making it, I usually have mine made by Mr. A. E. Evans, 38, Fitzroy Street, London, W.1.

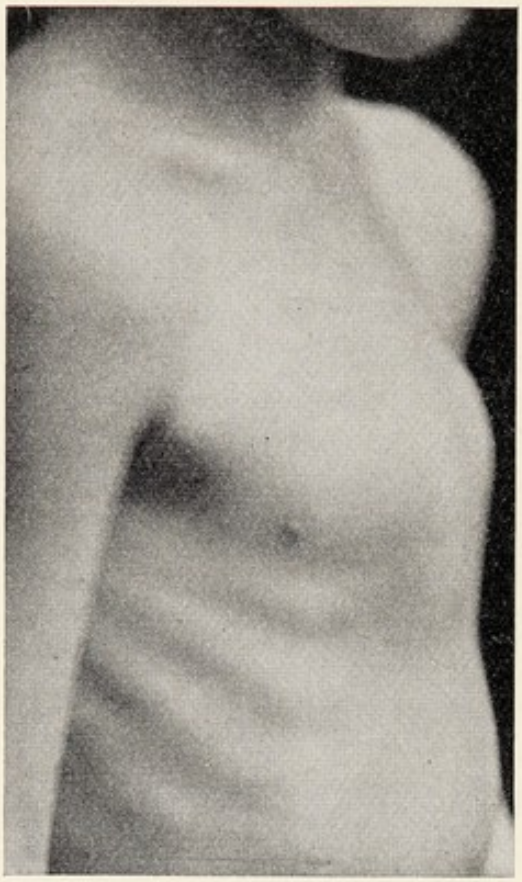


FIG. 31.—Pigeon Chest, before Treatment; aged 6 years. April, 1934.

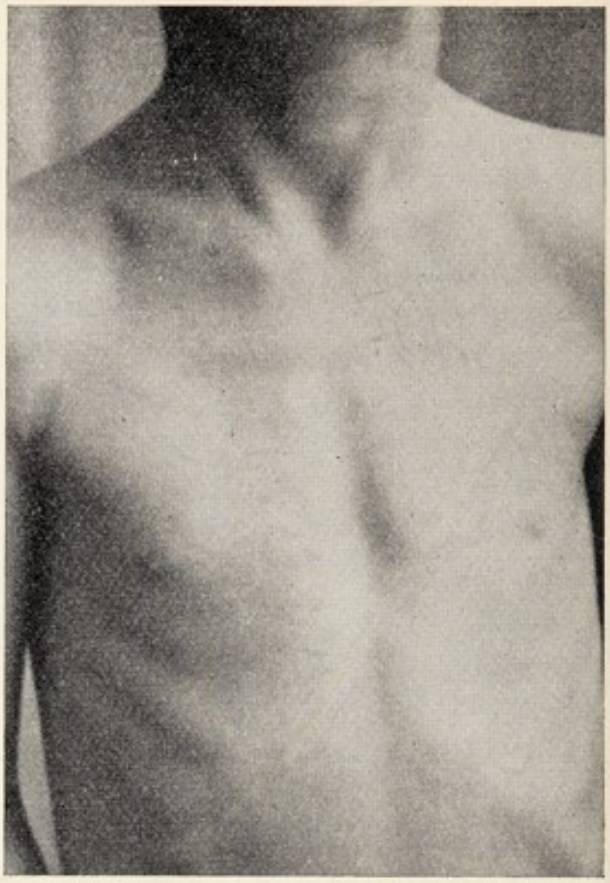


FIG. 32.—Deformity after Treatment; aged 9 years. April, 1937.

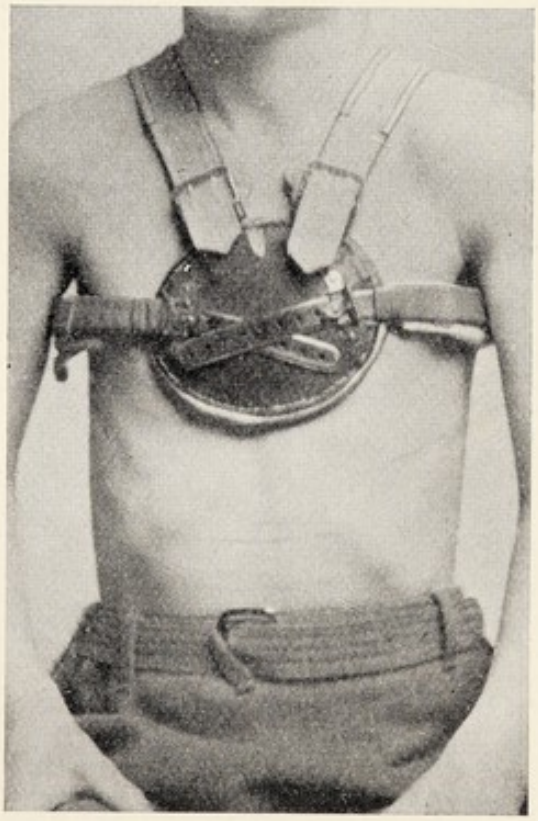


FIG. 33.—Remedial Apparatus. Front View.

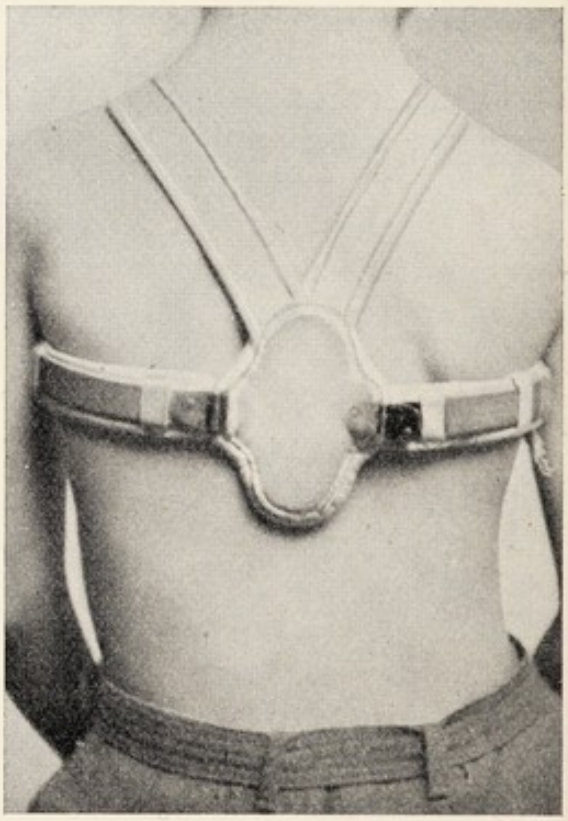


FIG. 34.—Remedial Apparatus. Back View.

restraint on the antero-posterior expansion of the chest—that is to say, without the apparatus—they are more likely to do harm than good.

Any obstruction to the superior air passages must of course be treated, but if such obstruction takes the form of stenosis of the anterior nasal passages by reason of contracted palate, thick septum, or enlarged turbinates, deep breathing exercises with the mouth shut are liable to accentuate the thoracic deformity rather than improve it.

Should there be any softness of bone due to rickets, this condition must be treated by appropriate means, as for instance by the giving of vitamin D (Radiostol solution : (B. D. H.) 10 minims, three times a day), and lactate of calcium, gr. 10, three times a day.

CONGENITAL ANOMALIES IN THE DEVELOPMENT OF THE NECK AND FACE

Clefts, Fistulæ, etc.

Apart from the congenital deformities above described, quite a number of defects may occur in the development of the face and neck, owing to failure of the primordial lobes to unite, or because certain of the embryonic clefts do not close completely. In this way fistulæ or tubercules sometimes develop, while teratomata or dermoid cysts occasionally grow in the region of the face and skull as excess formations from ectodermic inclusions. Among the more important of these developmental defects are :

1. An oblique facial cleft which extends in the form of a lateral hare-lip, outwards towards the nares, and upwards towards the eye. This is a rare deformity.
2. A transverse facial cleft which extends from the corner of the mouth upwards and outwards towards the ear on the same side. This also is a rare deformity.
3. Median branchial fistula, which is situated almost in the median line of the neck, inside the insertion of the sterno-cleido-mastoid muscle, and sometimes also opening internally under the tongue at the foramen cæcum. In place of a fistula a cystic tumour sometimes develops in the same situation under the tongue.
4. Lateral branchial fistula, situated at the anterior margin of the sterno-cleido-mastoid muscle, near the hyoid bone. It may have an internal opening in the neighbourhood of the tonsil. This embryonic structure

may also be encysted, or like its fellow median fistula it may secrete a serous fluid, and cause irritation or eczema.

5. Dermoid cysts are found mostly in the vicinity of the external angle of the eye, and in the neighbourhood of the osseous sutures or primordial fissures. They consist of a coarse sac, and contain fat, epithelium, hair, teeth, or other ectodermal structures.
6. Hygroma (Lymphangioma). This is a multi-locular tumour, situated in the neck and encircling the large vessels. It tends to grow downwards and causes strangulation of the larynx and œsophagus.

Treatment. The treatment of all these congenital deformities consists exclusively in radical extirpation or repair by surgical means. The operation should be undertaken as soon as the defect causes serious trouble. It is important that the extirpation should be complete, since any vestige left behind may develop anew into a cyst or fistula. Treatment of hygroma by surgical means is difficult, owing to its extensions to surrounding structures.

DEFORMITIES OF THE FACE

Hare-lip

This condition practically always calls for a plastic operation, so that the only matter which concerns the practitioner is at what time the operation should be performed. It is usually claimed that the operation should not be deferred beyond the 3rd or 4th week, but in some cases the condition of the infant does not warrant immediate operation, and in such circumstances time should be allowed for the health of the patient to improve. In all cases the latter should be partially fed beforehand by means of a spoon, since for the first few days after operation it is inadvisable for the baby to be fed directly from the breast or bottle. Hare-lip need not interfere with breast feeding, a circumstance which in view of the beneficial influence of the latter on nutrition is fortunate. If there should happen to be any trouble in connection with the infant taking the breast, the milk should be expressed and given by spoon or bottle, until the difficulties have been overcome.

Cleft Palate

Cleft palate, whether it co-exists with hare-lip or occurs independently, always requires surgical repair. The time for doing

this is when the infant is between 2½ and 3½ years old. Like hare-lip, cleft palate need not interfere with breast feeding. With a little patience and perseverance the infant can be taught to take the breast like a normal infant, and the same is true of bottle feeding. There is no need for any special nipple, so long as the artificial teat is large enough to fill up the cleft and to allow compression between the tongue and the defective palate (see page 35).

Malformations of the Palate

Certain defects in the palate, apart from deficiencies of bone, or soft tissues, are of sufficient pathological importance to demand special treatment.

A very high and narrow palate encroaches on the space of the anterior nares, leading to nasal obstruction, mouth breathing, and other undesirable results (see page 241). When such is the case, efforts should be made to widen the palate by artificial means. This can be done by the fitting of an obturator dental plate, which exercises pressure on the alveoli and gradually expands the palate. Dentists should not leave these corrections until the jaw has almost ceased growing. The earlier the orthodontic treatment is applied, the more amenable is the jaw to moulding, and the longer time the jaw has opportunities for growing into a correct position, the better will be the final result. There is no reason why a well-designed appliance should not be fitted during infancy.

Other Deformities of the Palate

Quite apart from cleft palate, there are a number of congenital deformities of the roof of the mouth, such as the " horse-shoe "-shaped palate, the " gothic arch " palate, and the " dome "-shaped palate. All these are liable in later life to cause trouble through interference with the respiratory functions. It must be remembered that the roof of the mouth constitutes the floor of the nose, and consequently any narrowing or elevation of the hard palate will encroach upon the available space in the nasal airways, rendering normal breathing difficult or impossible.

Under such conditions mouth breathing as well as adenoids and enlarged tonsils will almost certainly result. Narrowing of the nasal passages of sufficient degree to cause the turbinates to touch the septum is apt also to predispose to respiratory neuroses, such as asthma, or hay fever, to constitutional disturbances, or even to tuberculosis. For this reason any practical steps that can be taken to correct the deformity should be welcomed.

Treatment. The shape of the palatal arch is largely influenced by the mechanical forces which are brought to bear upon it after

birth, as indeed is proved by the forward projection of the anterior alveolar process of the upper jaw, which results from thumb-sucking, or from the continued use of a " comforter." The lateral stresses which normally act on the alveolar process of the upper jaw in the side-to-side grinding action of mastication is responsible in some degree for the usual widening of the palate, which takes place with normal growth. For this reason possibly all babies, and certainly all babies with malformed palatal arches, should be encouraged to masticate hard foods, such as crusts and biscuits, at the earliest possible date, since good habits of mastication will certainly lead to a favourable development of the jaws and palatal arch.

Modern orthodontic methods can now be applied with good effect in the case of quite young children with malformed palatal arches.

Prognathism

This is a defect in which one or both jaws are unduly prominent in a forward direction. Whether of mild or serious degree, this is a very unbecoming deformity, and should be corrected if possible by orthodontic means. As a rule dental surgeons are reluctant to commence treatment until the child is more than 6 years of age, which if not too late to have any beneficial results at all, is often too late to give the best.

There is however one form of prognathism in which there is considerable overhanging of the upper jaw, and defective development of the lower jaw, and which is very amenable to early treatment. Such cases if they remain untreated make a proper " bite " quite impossible, for the lower incisors cannot come in apposition with the upper ones, but bite behind them.

I have found that this condition can be materially improved if the lower jaw is stimulated by pulling it well forward with the finger hooked under the chin, and allowing it to knock against the upper jaw, by intermittent up-and-down movements. If exercises of this kind are carried out every day for a few months, the improvement in the development of the jaw is quite remarkable, and the younger the baby, the more immediate the result.

BONY DEFORMITIES OF THE EXTREMITIES

Arachno-Dactyly

In this condition, which is familial or congenital, the digits of both hands and feet are long and slender, so also are the bones

of the limbs. Muscular development is poor, the joints are flexed, and movements are restricted.

Treatment. There is no known treatment for this condition.

Talipes

There are four common forms of congenital talipes.

1. *Talipes Equinus*: In which the foot is plantar flexed.
2. *Talipes Calcaneus*: In which the foot is flexed dorsally.
3. *Talipes Valgus*: In which the foot is abducted.
4. *Talipes Varus*: In which the foot is adducted.

There are also various combinations of these deformities, such as talipes equino-varus, and talipes equino-valgus, names which sufficiently explain the kind of malformation.

Although in a small proportion (5 per cent) of cases there is clearly a familial factor in the etiology, in the minor degrees of the deformity, especially in the equino-varus variety, these abnormal conditions are to my mind capable of being explained on the grounds of a cramped position of the fœtus *in utero*. The fact however that some of the more serious of this kind of deformity are connected with central nervous defects, in which the control of the muscles supplying the feet is clearly interfered with, raises the question whether in most cases the *causa vera* of talipes is not to be referred to a central nervous cause.

Treatment.

Slight degrees of equino-varus is by far the most frequent variety of talipes, in fact it might almost be stated that the physiological position of the feet of new-born babies is always one of slight equino-varus. The practitioner is consequently often faced with the responsibility of deciding whether the adduction and plantar flexion of the feet at the time of birth represent a sufficient degree of talipes to require remedial treatment, or whether a correction of the malformation of the feet will come about without any artificial interference. If the position of the feet can be corrected easily by manipulation without the display of undue force, the condition probably requires no treatment; but should force be required, the feet should be flexed in a slightly over-corrected position by means of splints or strapping. In all cases in which splints are employed they should be occasionally removed, and the feet exercised in passive movements and thoroughly massaged. In this way atrophy of muscles will be avoided.

The more serious degrees of talipes must be treated by the rapid method of forcible wrenching under full anæsthetic, with subsequent fixation in plaster of Paris in an over-corrected

position. The objection to the plaster of Paris splint is that it is usually difficult to remove, and without occasional removal, massage, and passive exercises, the muscles of the leg fail to develop, and a functional disability is substituted for the structural deformity. Since for obvious reasons it is usually impossible to apply plaster of Paris splints to new-born babies, for the correction of severe degrees of talipes, it is generally advisable to begin the treatment by the less drastic expedient of fixation in as good a position as possible by means of strapping, leaving the wrenching into position till a later date.

Coxa Vara

In this rare condition, which is occasionally congenital, the neck of the femur makes with the shaft of the femur a smaller angle than normal.

The thigh is adducted and abduction is restricted. The gait is waddling, or limping, according as both hips or only one are affected.

The diagnosis is made by means of X-rays, and the treatment is surgical.

INFLAMMATORY DISEASES OF BONE

Osteomyelitis

Cases of osteomyelitis generally commence as small inflammatory areas in the cancellous tissues in the metaphyses of long bones, followed by rupture of the thin layer of compact bone which covers them, and with the formation of subperiosteal abscesses.

The diagnosis lies as a rule between this disease and acute rheumatism, but in osteomyelitis only one joint is affected : in rheumatism several. Radiography affords no help in the early diagnosis of the disease, when its recognition is most important.

Other conditions for which it may occasionally be mistaken are scurvy, fractures, septicæmia, cellulitis, erysipelas, poliomyelitis, and arthritis. The diagnosis is sometimes extremely difficult in the case of the bones of the pelvic girdle, and of the vertebral column. I think I have seen more mistakes made in connection with osteomyelitis in such unexpected sites, than in regard to any other class of disease. When there is great pain, tenderness, and the ordinary symptoms of an acute septicæmia, for which no reasonable explanation is forthcoming, the possibility of an osteomyelitis should be borne in mind. Although the staphylo-

coccus is responsible for about 90 per cent of all cases, both the pneumococcus and the streptococcus occasionally produce it.

Treatment. *Prophylactic.* In view of the etiology of this condition any existing staphylococcic disease of the skin, streptococcic infection of the tonsils, or pneumococcic infection of the respiratory system, is a potential source of the trouble, and as such must be treated by energetic means; while the possibility of a bony injury as the determining factor, must be borne in mind.

Curative. According to modern practice the treatment consists in draining the actual seat of infection in the cancellous portions of the metaphyses, by making an opening with a small chisel or drill, if the exact site can be determined, care being taken to avoid damaging or secondarily infecting the epiphysis, or medullary cavity. By these means tension is relieved and pus or inflammatory exudate evacuated. Cultures from the material removed may reveal the precise nature of the infection, and allow of specific serum treatment, which is often effective. In the case of streptococcal infections Prontosil (page 699) may be tried.

Epiphysitis

Although the usual forms of epiphysitis in young children are of a syphilitic or tuberculous nature, it occasionally occurs from the same causes and under the same circumstances which produce osteomyelitis, with the difference that the inflammation starts in the cancellous portions of the epiphyses, instead of in the metaphyses. Septic arthritis usually follows, and should be treated on the lines indicated in the appropriate section (page 611).

Separation of Epiphyses

This occasionally occurs as a result of trauma, but more often in consequence of scurvy or syphilis. It may be diagnosed by radiographic means. Crepitations such as occur in ordinary fractures of bone are usually absent, but there may be a crackling such as is elicited in cases of osteoarthritis. There is usually severe pain on movement or handling.

Treatment. This is by rest, splinting, and other surgical procedures.

Tuberculous Disease of Bone

Although ultimately tuberculous processes affecting bone nearly always invade the joints, more often than not they commence in the articular ends of the bone, as is the case of osteomyelitis. The inflammation is usually determined by trauma, often

extremely trivial in character, although the child is always the subject of an existing tuberculosis either of the respiratory, digestive, or lymphatic system. The order of frequency of the joints affected is as follows: the spine, hip, knee, ankle, elbow, shoulder, and wrist.

The diagnosis depends on the presence of the general symptoms of a tuberculous infection, and on local signs of pain, disability, swelling, limitation of movement and muscular wasting, especially of the muscles in and around the affected joints. Radiological evidence is also of value.

Treatment. *Prophylactic.* Preventive measures include the treatment of the underlying tuberculosis, and its prophylaxis by means of the measures described on page 438.

Curative. This consists in the general treatment of the underlying tuberculosis.

Local treatment may be summed up in the words—rest, splinting, immobilization in bed, and the prevention of deformities and bed sores.

The treatment of abscesses, should these arise in connection with tuberculosis of bone, is in accordance with modern procedure of a strictly conservative nature. It is seldom advisable to open such abscesses and scrape the cavities: they should rather be treated by judicious aspiration, or left severely alone. Abscesses, however, which become secondarily infected with pyogenic organisms, must be opened and treated in the ordinary way.

The treatment of tuberculous diseases of the spine, spinal caries, Pott's disease, or hip disease, is of special character requiring the services of an expert, and hardly comes within the scope of this book.

Syphilitic Disease of Bone

Syphilitic affections of bone take a variety of forms. First of all there is a variety of epiphysitis, which is so common among syphilitic babies and young children affected with this disease, that its presence as shown by X-rays is one of the most pathognomonic evidences of the existence of the syphilis itself. The specific inflammation commences in the epiphyseal line of the metaphyses and extends to the adjacent periosteum. Subsequently the epiphysis becomes separated. In such cases there is usually a sort of pseudo paralysis of the affected limb, due to pain on movement. Apart from epiphysitis, the other bony lesions found in syphilis are dactylitis, atrophic thinning of the cranial bones (cranio-tabes), and hyperplastic thickening of the cranial bones, giving rise to Parrot's nose or "Hot-cross bun" scalp.

Dactylitis.

Dactylitis is an occasional variety of bone infection found in syphilitic children. It generally attacks the proximal phalanges of the hands, and sometimes the feet. It is painless, but often closely resembles tuberculous dactylitis, from which it can be distinguished by absence of pain.

Another variety of bone affection is a form of hypertrophic osteoperiostitis, giving rise to deformities which are not unlike osteoperiostitis deformans. The thickening of the shaft of the tibia, " sabre-blade " tibia, is an example of this, and may be mistaken for rickets, but may be distinguished from it by the thickening being confined to the middle third of the bone, instead of at the ends, as in rickets.

Treatment. The treatment of syphilitic disease of bone, both as regards prophylaxis and cure, is the same as that described in the section on Congenital Syphilis (page 163).

Leontiasis Ossea

This very rare condition consists in a thickening of the bones of the head, leading to obliteration of the air-sinuses and narrowing of the foramina through which pass the nerves and blood-vessels, and also to a decrease in the size of the orbit, giving rise to exophthalmos. Symptoms due to pressure on the blood-vessels and nerves are very various.

Treatment. There is no known means of treatment, except surgical measures to relieve the pressure symptoms.

Fragilitas Ossium

This term is merely a descriptive title given to a symptom, namely, a liability on the part of bones to fracture on slight provocation. The condition occasionally occurs in rickets, cœliac disease, osteomyelitis, and syphilis, and in such cases the treatment is that of the primary disorder.

The term however is also applied to a similar condition of bone in osteogenesis imperfecta, a congenital disease in which multiple fractures occur, both before and after birth. This disease appears to be an independent disease entity, and as such deserves individual description (page 585).

Clubbing of the Fingers

(Hippocratic Fingers : Drumstick Fingers)

This condition which usually involves the toes as well as the fingers, may also be accompanied by a somewhat similar condition

of congestion of the ears and nose. It may be associated with a number of chronic infective respiratory disorders, more particularly with bronchiectasis, empyema, or chronic pulmonary tuberculosis. It is also met with in circulatory diseases, especially in congenital heart disease. Other conditions with which it is occasionally associated are chronic jaundice, hypertrophic biliary cirrhosis, pyelonephritis, and osteo-arthropathy. Whatever may be believed to be the cause of this condition, it must be one which will explain its presence in both pulmonary and circulatory disabilities, as well as in septic conditions. Most of the explanations which have so far been given do not fulfil these conditions. There is reason to doubt that it is due to the effect of toxins acting on the soft tissues of the finger-ends—a view commonly held—or that it is due to the mechanical effect of cardiac insufficiency. Dr. Jean Smith has made the ingenious suggestion, which is supported by some independent evidence, that clubbing, especially in cases of congenital heart disease, is caused by an excessive volume of blood in the body, a condition which may well cause a vascular congestion in terminal parts which are not well supported, or when the local circulation is carried on under disadvantageous circumstances.

Treatment. Both prevention and cure of this condition consist in the treatment of the primary trouble with which it is associated. The clubbing disappears as soon as the parent condition yields to treatment. As bronchiectasis is the most frequent cause, special attention should be given to the possibility that this condition is at the root of the trouble. In view of the explanation that an excessive volume of blood may be the cause of clubbing, it may well repay the practitioner to have a test applied to ascertain whether this is so or not. If the answer is in the affirmative, expedients for the reduction of the volume, such as limitation of the intake of fluid, diuresis, diaphoresis, and purgation, are therapeutic measures which are worth trying.

TUMOURS OF BONE

Simple Tumours

Cysts

Simple cystic tumours of bone are exceedingly rare in infants and young children. They may be single or multiple.

Single Cysts

Solitary cysts occasionally occur in the ends of the long bones, namely, the humerus, the femur, and the tibia. The condition

appears to be allied to osteitis fibrosa cystica. When these cysts occur they may result in a fracture of the so-called " spontaneous " variety. There is as a rule little difficulty in making the diagnosis which can be confirmed by radiographic means, the latter shows great thinning of the cortex round the cavity of the cyst.

Treatment. In cases complicated by fracture, the fracture should be allowed to unite before any attempt is made to deal with the cyst itself. The treatment for this consists in opening the cyst, scraping out the contents, and crushing in the walls so as to obliterate the cavity.

Multiple Cysts

Considerable attention has recently been focussed on this condition, and as a result it has been divided into two categories :

(1) Generalized fibro-cystic disease, with no disturbance of calcium metabolism.

(2) Generalized fibro-cystic disease with increase of blood calcium.

(1) Generalized Fibro-cystic Disease, with no Disturbance of Calcium Metabolism. Two cases have been reported in which the bony changes were confined to one side of the body, and in one of these the temporal region of the skull was the seat of Leontiasis.[1] In neither of these was there any concomitant disturbance of calcium metabolism.

Treatment. For cases of this kind there does not appear to be any method of treatment.

(2) Generalized Fibro-cystic Disease, with Increase of Blood Calcium. This group of cases is associated with the over-secretion of the parathyroid glands, and an increase in the blood calcium.[2] In these cases the bones become decalcified as a result of the increase in the parathyroid secretion. Pain and fragility of the affected bones are marked features of these cases.

Treatment. The treatment depends entirely on that of the underlying condition, that is to say, by the removal, if such is possible, of part of the parathyroid system.

Exostoses

There are several varieties of this disease which appear to merge one into the other, and for which various names have been given, such as dyschondroplasia, hereditary deforming chondrodysplasia, multiple cartilaginous ostoses, diaphyseal aclasis, Ollier's disease,

[1] Fairbank and Barrington-Ward.

[2] Donald Hunter, Mandl, and Collip.

etc. They all, however, have certain features in common, as, for instance, they are congenital in origin, and have a marked familial tendency, with a predilection for the male sex. They appear also to belong to the same category of disease as achondroplasia. There are multiple exostoses, or enchondromata, which affect both cartilaginous and membranous bones. There are various deformities, which in one particular variety, namely, so-called Ollier's disease, are confined to one side of the body. In the more usual, or bilateral variety of case, the whole of the body is more or less stunted, and especially the arms and legs. A variety of deformities result owing to the unequal length of the paired bones, as for instance, the radius and ulna, with the result that the radius becomes bowed, and the distal end dislocated, giving a very characteristic and peculiar appearance to the wrist, which allows the hand to be unduly flexed on the forearm. Scoliosis, pes cavus, and knock-knee, may also result, while the exostoses themselves may cause limitation of movement.

The cause of this disease, like that of achondroplasia, is unknown, though it has been ascribed to some interference with the function of the endocrine glands. This explanation appears to me to be unlikely in view of the unilateral distribution of the lesions in Ollier's variety of the disease. The disease does not as a rule progress to a fatal termination, but tends to retrogression after adult life has been reached.

Treatment. This consists in the surgical correction of deformities, and the removal of exostoses which interfere with the mobility of joints.

Malignant Tumours of Bone

Although there are many different varieties of malignant tumours affecting the bones of children, they are all extremely rare. Sarcomata of different types constitute a considerable proportion of the total. Malignant tumours of the adrenal medulla (hyper-nephromata) give rise to metastatic growths in the bones of the skull, which present a very characteristic appearance, and are often accompanied by unilateral ecchymosis of the conjuctiva and proptosis.

Treatment. The treatment of malignant disease of the bones in children depends on whether the growth can be removed by surgical operation or not. It is only in those cases in which the growth is of the extremities, and in which amputation can be performed, that surgery offers any prospect of success. Before operation is undertaken the diagnosis of malignancy should be definitely settled. In cases of doubt preliminary X-ray treatment

may help in the diagnosis, because in the case of simple tumours there is generally some improvement after a few weeks' treatment, whereas in cases of osteogenic sarcoma there is none. If operation is possible, and is undertaken, it is extremely important to prevent embolism and metastatic growths, by the application of two tourniquets, one immediately above the growth, and the other high up on the proximal side, the amputation incision being confined to the space between the two. Great care should also be taken not to move the neighbouring joint forcibly, nor handle the tumour roughly. Coley's fluid has been found successful in a few cases, and therefore deserves a trial.

Arthritis

In addition to the more generally recognized varieties of arthritis, that is to say, the tuberculous, syphilitic, pneumococcal, gonococcal, rheumatic, and rheumatoid types, there are other forms which occasionally occur, and which although infective, do not belong to any of those categories. Among these are the arthrites which develop as complications or sequelæ of such general infections as typhoid fever, influenza, diphtheria, scarlatina, Vincent's angina, tonsillitis, mumps, measles, and poliomyelitis. For the most part these are non-suppurative forms, but they occasionally take on a pyogenic character. There are still other forms of arthritis which are toxic in nature, as, for instance, those which occur in gout, serous disease, purpura, hæmophilia, urticaria, and some of the erythemas. Schlesinger has suggested that the rare condition of intermittent hydrarthrosis in which certain joints become suddenly painful and swollen, and as suddenly recover, may be of the same nature as angio neurotic œdema, but I believe that no case of this kind has so far been reported as occurring in a child under 5 years of age.

Treatment. Cases of arthritis belonging to any of the above categories must be treated on the general principles of giving rest to the affected joint, and treating the underlying disease on the lines indicated in their appropriate sections.

Tuberculous Arthritis.

The joints most commonly affected in tuberculosis are those of the spine, hip, knee, ankle, elbow, shoulder, and wrist, and in this order of frequency. The inflammatory process starts as a rule in the medullary part of the bone, near the epiphyseal line, but rapidly penetrates into the interior of the joint.

Treatment. *Prophylactic.* The prophylaxis is that of the primary disease, since in every case of tuberculosis in a child

there is a potential danger of the disease becoming localized in a joint.

Curative. The general treatment consists in rest, fresh air, heliotherapy, suitable climate, massage, and a correct dietary, which must contain a sufficiency of calcium and other mineral elements as well as the vitamins.

Specific treatment by tuberculin is of very doubtful value.

Local treatment consists in fixation of the affected joint, and complete immobilization. Abscesses should not be opened unless they become secondarily infected with pyogenic organisms. If, owing to distension of an abscess cavity, there is any danger of spontaneous rupture, the question of aspiration must be considered. If this becomes necessary, the operation should be carried out by inserting the needle obliquely through a tract of healthy subcutaneous tissue, rather than directly into the abscess through a thinned-out area of skin which may easily become the seat of leakage and subsequently lead to the development of a sinus or fistula. The artificial production of a local hyperæmia by Bier's method, with radiant heat, or by the application of a kaolin poultice (Cataplasma Kaolini B.P.) are in my opinion of value in the treatment of the acute stages of inflammation in an easily accessible joint.

Syphilitic Arthritis.

Syphilis affects the joints of infants and young children in two ways :

(1) As an epiphysitis which commonly occurs in the first few months of life and may lead to the complete separation of the epiphyses, a condition which presents a very characteristic X-ray picture.

(2) As a synovitis. This usually develops at a later period of childhood. The synovial membrane is thickened and boggy, but there is no actual fluid in the joint. This condition develops insidiously, and is painless. The knee-joint is the one usually affected.

Treatment. *Prophylactic.* Preventive treatment consists in the recognition of the primary disease and its specific treatment (page 161).

Curative. In all its forms, except those which are complicated by suppuration, syphilitic arthritis yields very readily to specific treatment. There is no need to employ splints, or to insist on complete immobilization of the patient in bed, although the amount of exercise allowed must be limited. The general treatment of the primary disorder by ordinary anti-syphilitic treatment

is usually quite sufficient without resorting to local treatment, although some authorities still adhere to the old method of applying Scott's dressing to the affected joint.

With dislocation of the epiphyses, or suppuration of the joint, rest must be insisted on, and the condition treated on ordinary surgical lines.

Gonococcal Arthritis.

This condition is rare in infants and children under 5 years of age, but there is always the possibility of it supervening in a case of conjunctivitis in the new-born, or one of vulvo-vaginitis in older children. It generally develops about 3 weeks after the primary infection. The prognosis is as a rule good, unless secondary pyogenic infection leads to suppuration and disintegration of the joint.

Treatment. *Prophylactic.* This consists in the avoidance of the primary disease by the preventive expedients described in the section which deals with ophthalmia neonatorum (page 160). In older children gonococcal infection sometimes follows from contact with infected towels, sponges, thermometers, fingers, and also directly from infected persons ; in a few instances epidemics have occurred in institutions. Prophylaxis consists therefore in observing precautionary measures directed against such accidental infection.

Curative. Apart from that of the primary source of infection, local measures consist in immobilizing the affected joint by splints, either in plaster of Paris, aluminium, or wood. For chronic cases specific treatment is recommended by means of gonococcal immunigen (P. D. & Co.) in increasing doses, given by hypodermic injection on alternate days, commencing with a dosage of 0·01 c.c. and gradually increasing up to 0·1 c.c.

Rheumatoid Arthritis (Still's Disease).

This disease is almost certainly the juvenile form of the ordinary rheumatoid arthritis of adults. It is undoubtedly infective in origin, but it is quite different from the other varieties of arthritis which are due to known causes, such as those already described in the preceding paragraphs. The involvement of the joints is accompanied by swelling of the spleen and lymphatic glands. The joints usually affected are the knees, wrists, ankles, interphalangeal, metatarso-phalangeal, and cervical. The joints are usually symmetrically affected and present a characteristic fusiform swelling. Little pain is experienced, and there is no actual effusion into the joints. Movement is restricted, and a crackling crepitus can be elicited. Although it is generally believed that

this condition is the result of infection with some special form of streptococcus, the actual agent may be of the nature of a virus acting either independently, or in association with some such organism. Constitutional and debilitated states in the child appear to influence the degree of susceptibility, and the severity of the attack, that is to say, the specific nature of the disease may be as much due to the specific reactions of the tissues as to the specific nature of the infecting organism.

The disease has to be distinguished from tuberculous and syphilitic arthritis, as well as from ordinary acute rheumatism.

Treatment. *Prophylactic.* Since the cause of rheumatoid arthritis is not definitely known, no specific precautions can be taken against the disease, but it is possible that the early treatment of infective disorders such as septicæmia, tonsillitis, syphilis, and tuberculosis, all of which appear to predispose to the disorder, may be effective steps in the prevention of the disease itself.

Curative. The treatment of so chronic a disease as rheumatoid arthritis greatly tries the patience and taxes the resources of those who are in charge of the case. Since the debilitating effects of the disease, or the debilitated states which predispose to it and intensify its severity give rise to almost as much anxiety as the disease itself, every possible hygienic expedient which can in any way promote the general health of the individual must be pressed into service, and every means taken for increasing resistance. Every effort also should be made to discover any possible source of infection localized in the ears, tonsils, sinuses, or intestinal tract, which may directly or indirectly influence the general bodily health.

Good and correct feeding, especially as regards the accessory factors, is therefore a very essential part of the treatment, although over-feeding should in every way be discouraged, owing to the restricted requirements incidental on the immobilization of the child in bed. Appetite must be encouraged by means of fresh air, massage, and gastric stimulants, such as gentian and hydrochloric acid.

As regards local treatment, although rest in bed is essential during the acute stages of the disease, the advisability of complete immobilization of the affected joints by means of splints or extension apparatus must always have due consideration. As a rule, however, it is unnecessary to make resort to either of these procedures, as the child is usually disinclined to make voluntary movements owing to the pain they cause. All forced manipulations, wrenchings, and other stock-in-trade of osteopaths and bone-setters, should be studiously avoided. Massage, however, may be resorted to in the later stages.

Other local treatment may take the form of Scott's dressing, ionization, anodic galvanism, radiant heat, infra-red and ultra-violet radiation, and diathermy. All these have been tried from time to time with varying degrees of success.

Bier's hyperæmic method is definitely useful in the later stages, while in cases which respond to no other form of treatment "hyperthermia" may be resorted to. This consists in raising the patient's temperature to about 105° F. and maintaining it at this point for 5 hours by placing him in a Warren's Radiant Energy Cabinet, or "Sweat Box," a wooden box heated by electric-light bulbs, which fits over the bed and encloses the reclining patient completely, except the head itself. Three courses of this treatment should be given at weekly intervals. Constant attendance and care are necessary during the carrying out of these procedures. The patient's temperature should be taken at short intervals and he should be allowed to drink as much cold water as he likes.

Drugs. There are no drugs which have any specific influence on the course of the disease itself, and so far no specific serum or vaccine is available. For the relief of symptoms, various expedients may be employed. For the general debility and anæmia, iron, arsenic, and thyroid preparations may be tried. For the sleeplessness, bromide is useful, while for the constipation there is probably nothing better than an ordinary emulsion of petroleum, such as semprolin. Personally, I believe very strongly in the advantage of disinfecting the intestinal tract. This can be done by giving daily small quantities of milk soured by means of some lactic acid organism (Acidophilus or Bulgaricus). If this treatment is patiently pursued until the motions become practically odourless, the patient's general condition is usually improved.

In contradistinction to the plan almost universally adopted throughout this book of giving only one method of treatment, which relieves the reader of the responsibility of making a choice between alternative procedures, several different ways of dealing with rheumatoid arthritis have been described. This has been done because my own experiences have taught me that a line of treatment which is successful in one case, may fail in the case of others. For this reason I suggest that the following measures should be tried first, and if they do not succeed, some of the other alternatives described should be tried in succession. The child should be kept in bed with the affected joints bandaged, but not otherwise immobilized. Radiant heat treatment should be applied daily during the acute stages for about 1 hour on alternate days. Complications should be treated as they arise, but in all

cases intestinal toxæmia should be controlled by the sour-milk method, and of course the dieting should be conducted on physiological lines. As a final recourse in chronic cases in which no favourable response to treatment has been effected Prontosil may be tried (page 699).

Congenital Dislocation of the Hip

With this deformity, both hips may be dislocated, or only one. It is seven times as common in girls, as in boys. It is probably due to an incomplete adaptation in the course of animal evolution to the requirements of the erect position, or to a throw-back to a more primitive state. The acetabulum is shallow, and points more to the front than is normal, as in quadruped animals. The actual dislocation may be deferred until the child begins to walk, which is generally not until he is some 2 years of age.

With a single dislocation there is a limp: with a double dislocation the gait is waddling. The diagnosis can be confirmed by X-rays, but in the case of young babies, owing to want of ossification, the exact depth of the acetabulum is not easy to demonstrate, and there may be as yet no dislocation.

The treatment, which should begin about the 3rd year, and not later than the 10th year, should be by Lorenz's bloodless method of manipulation, with retention in the corrected position by means of plaster of Paris splints, which must be worn for many months followed by specially devised exercises.

CHAPTER XVII

DEFORMITIES AND DISEASES OF THE MUSCULAR SYSTEM

Torticolis

Congenital torticolis, or wry-neck, is a condition in which the head is drawn down to the shoulder on the affected side by an organic shortening of the sterno-mastoid muscle. The face is

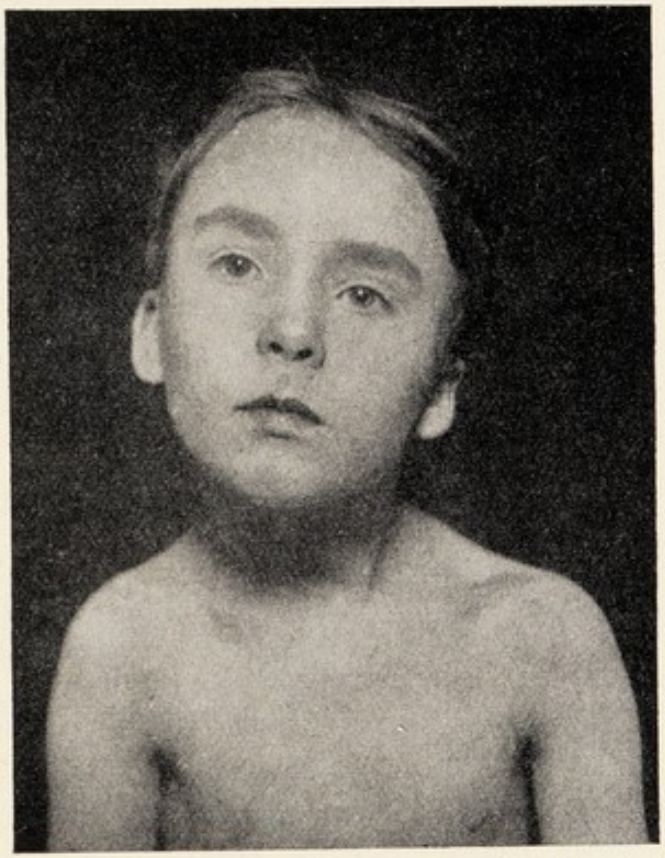


FIG. 35.—Congenital Sterno-Mastoid Torticolis.

(By permission from the photographic collection of the Hospital for Sick Children, Great Ormond St.)

rotated to the opposite side, and the chin tilted upwards. As the head and face continue to grow asymmetry of the face usually develops, in which the half on the affected side is smaller than its fellow on the opposite side. There is usually also a corre-

sponding shortening in the associated neck muscles, and ultimately the cervical vertebræ may become distorted in shape.

The cause of this condition is variously ascribed to a cramped position *in utero*, or to an ischæmic contraction of the muscle, similar to that which occurs in Volkman's paralysis of the muscles of the forearm. The latter is due to prolonged pressure on, and occlusion of, the artery which supplies the muscles of the forearm. In the case of the sterno-mastoid muscle, the artery is the superior thyroid. Personally, I believe in the first alternative, and see in the condition some analogy to that somewhat rare condition Klippel-Feil's disease, or wry-neck, which is described on page 592.

Congenital torticolis is occasionally mistaken for one of the acquired varieties, owing to the fact that congenital torticolis is sometimes at first so slight that it is not noticed, and only becomes obvious with the general growth and development of the child. Congenital torticolis has to be distinguished therefore from the following acquired varieties :

1. *Rheumatic Torticolis.* Due to myositis or fibrositis. This condition is painful and develops suddenly.
2. *Spinal Caries.* This is also painful, and can be recognized by X-ray examinations.
3. *Reflex Torticolis.* Due to retro-pharyngeal abscess, tonsillitis, peri-tonsillitis, or cervical adenitis.
4. *Sterno-mastoid Tumour with Habit Torticolis* (described on page 615).

Treatment.

Prophylactic. None, except possibly ante natal obstetric measures.

Curative. Treatment should be commenced at once, even in very mild cases, to prevent progressive deformity and facial asymmetry. Manipulative treatment is sometimes successful in slight degrees of deformity. The infant's face should be turned to the affected side, with the chin lowered as far as possible, and it should be forcibly held in this position for a few minutes every day, and if possible maintained in this position by sandbags, strapping, or other suitable devices when the infant is asleep. In those cases in which the degree of torticolis warrants severer measures, a leather or poroplastic collar may be applied, extending as low down as the shoulder, and upwards as far as the chin and occiput, and so designed as to over-correct if possible the faulty position. For more serious cases still, the sterno-mastoid muscle may be divided near the sternal end, but it must be remembered

that in such cases other muscles, notably those of the cervical spine, may also be involved, and the simple operation of section of the sterno-mastoid muscle only, need not necessarily correct the whole of the deformity.

ACQUIRED POSTURAL, STATIC, AND RACHITIC DEFORMITIES

Flat Foot

In infants and young children this is nearly always an acquired condition, although occasionally it is of congenital origin. The acquired condition is due to one or other of the following causes :

1. Ligamentous weakness and stretching.
2. Loss of muscular tone or paralysis.
3. Genu valgum (Knock knee).

In the great majority of cases the deformity develops in heavy, over-fat, muscularly feeble children, who, when they begin to walk, straddle their legs widely in order to maintain balance. The degree of flattening can be roughly gauged by taking an impression of the sole of the foot on paper, after wetting the skin with water.

Treatment.

Prophylactic. This condition, like that of knock knee, is usually ascribed to rickets, but except in so far as weak muscles and lax ligaments can be attributed to this cause, it is extremely doubtful whether rickets has anything to do with the condition. This latter disease has quite enough to answer for without being burdened with all the other symptoms which are due to the various excess and deficiency diseases which occur independently, or in conjunction with it.

This deformity, like many others of the feet and legs, is often ascribed to the fact that the child is allowed to walk too early. I think that this is an entirely wrong interpretation, and that it is due rather to the fact that the child walks too late and that the legs have been given too little opportunity for exercise, before the child reaches the walking stage. If infants are encouraged to kick freely and use their legs in various ways, as in dancing on their mothers' laps, or in climbing up her body with the assistance of her arms, their muscles, bones, and ligaments will all be stimulated to growth and development, and become so strong before the child actually takes to walking, that there will be no straddling of the legs and no " giving " at the instep. Infants who

are debilitated by nutritional diseases and loss of muscular tone are exceedingly liable to develop flat foot when they begin to walk, owing, as I have already explained, to the straddling of the legs in order to maintain balance.

The prevention of flat foot depends not only on the exercise of the ordinary functions of the muscles, bones, and ligaments of the legs during the early days of life, but also on the proper feeding and hygienic management of the infant, for want of which debilitated conditions frequently arise. The provision of adequate supplies of vitamin D and calcium salts may prevent the characteristic rickety changes in bone, but they will not necessarily prevent flat foot. I have frequently met with cases of babies who, although carefully treated on ordinary anti-rachitic lines, have developed flat foot and weak muscles, without their bones showing any evidence of defective ossification.

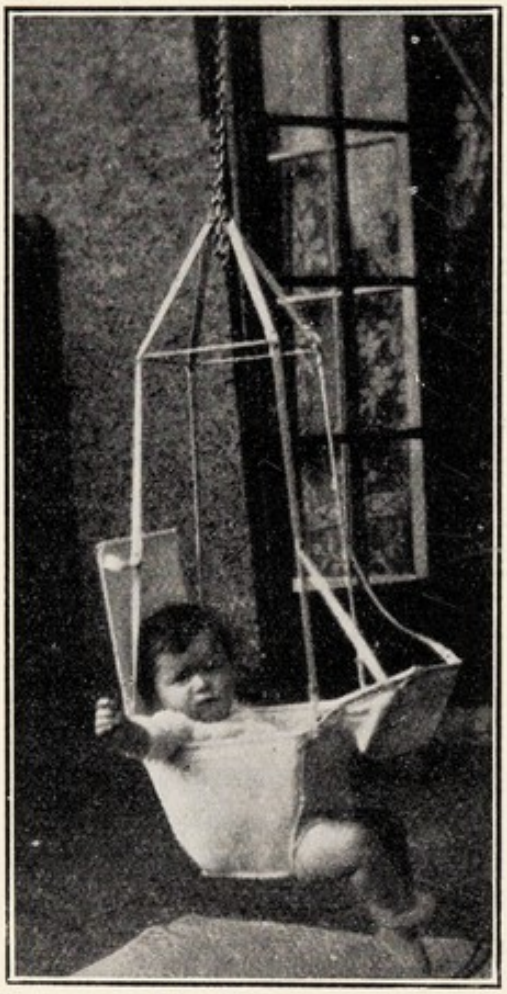


FIG. 36.—The Youpa-la Exercise Chair.

Curative. The earlier treatment commences, the better the result. It consists in correcting all the faults in feeding and general management which lead to malnutritional states, and in toning up the muscles of the legs by massage, passive exercises, and cold douching. In cases of early flat foot the arch of the instep must not be allowed to become further flattened by the imposition of the body-weight in standing or walking, until the remedial procedures have rendered it sufficiently strong to stand the strain. For this reason a little loss of body-weight by an over-heavy infant is all to the good, and the employment of some such apparatus as that shown in Fig. 36, namely, the Youpa-la exercise chair, which allows the child to feel his legs without imposing any undue strain or weight upon them, will be found a most convenient means of correcting any tendency to flat foot.

With very much the same object, the child may be allowed at a later date to ride a toy cycle or cycle horse. The cure is

also promoted in older children who are beginning to walk and are difficult to keep off their feet, by so-called "foot drill," *i.e.* a sort of heel-and-toe exercise which consists in making the child walk with parallel feet and teaching him to impart the impetus for each step through the action of all the toes, rather than by that of the ball of the big toe alone. This exercise should of course be supervised by someone who has experience in it. Suitable footgear must also be provided, in which the inner border of the sole and heel are wedged up, and a valgus pad inserted within the boot itself.

Pes Cavus

(Claw Foot: Talipes arcuatus)

This condition is sometimes hereditary, but is usually acquired in later childhood. It has been attributed to paralysis of the small muscles of the feet, or to some disproportion between the rate of growth in the bones of the foot and its soft parts. It consists essentially in an exaggeration of a normal physiological condition, and it is usually combined with limitation of dorsal flexion of the foot on the leg, and in shortening of the tendo Achilles.

Treatment. *Prophylactic.* A slight exaggeration of the normal arch of the instep is quite common in babies and in young children, without entitling it to be called pes cavus. These mild degrees can be treated by adduction, massage, stretching, and the wearing of a metatarsal bar.

Curative. In mild cases the same procedure as that recommended above for prophylactic purposes may be sufficient to prevent the case developing to a serious degree, but if it is bad enough to demand operation, the plantar fascia may be divided, and the foot wrenched into a better position, or Steindler's method of stripping the os calcis of its muscular and ligamentous attachments and thus allowing the arch to be flattened out by manipulation, may be resorted to.

Hallux Varus

(Pigeon Toe)

This is a hereditary condition, and consists in the adduction of the big toe, and an increase in the interval between it and the second toe. It is sometimes met with in mongolian or otherwise degenerate babies, and has been supposed to represent a reversion to the prehensile toe of our Simian ancestors.

Treatment. As a rule this condition requires no special treat-

ment, and the peculiarity disappears when boots or shoes are worn, but should the deformity persist, it may be corrected by applying a strip of strapping so as to maintain the toe in the correct position.

Hammer Toe

This deformity consists in the acute flexion of the proximal, and the hyper-extension of the distal interphalangeal joints of the toe.

Treatment. This consists in the application of a " T "-shaped aluminium splint, held in proper position by strapping, or in intractable cases by an operation which takes the form of excising the head of the 1st phalanx, with shortening of the extensor tendon.

Overlapping Toes

This congenital deformity is quite common, and consists in one of the toes, usually the 2nd or 3rd, over-lapping its neighbour.

Treatment. It is usually cured by the application of a strip of strapping which is passed over the elevated toe and beneath the under one. In older children a " toe-post " boot and stocking may be worn.

Bow-Leg

This is an exaggeration of the normal sickle-shape curvature of the tibia. It is a very common deformity in infants and young children. When the curvature is of extreme degree it is called bow-leg, but the milder cases are commonly attributed to rickets, and are described simply as " curved tibiæ." The term *genu varum*, which includes most cases of bow-leg, should be properly restricted to a condition in which the femur as well as the bones of the lower leg takes part in the excessive curvature, and which brings about a considerable separation of the knees. The majority of cases of bow-leg met with are associated with rickets, but in these the natural curves of the tibia become exaggerated when the weight of the body is imposed on bones already softened by rickets. It is a mistake, however, to believe that all bow-legs are rachitic in origin. Unless the natural curvature of the tibiæ in new-born babies, which is due to the crossing of the legs on the abdomen in the fœtal position, is straightened out after birth by traction of the attached muscles in kicking and other forms of exercise, the tibiæ retain their ante-natal shape independently of any existing rickety complication. This persistence of the fœtal shape of the tibiæ is often believed to be due to rickets,

and is treated as such with vitamin D and calcium salts, without, of course, any benefit. In fact, the undue hardness of bone which is brought about by this treatment may actually interfere with any subsequent osteoclastic operation which may be considered necessary for the correction of the deformity.

Treatment.

Prophylactic. Exaggerated tibial curvatures in feeble and degenerate babies can be to some extent prevented from developing into more serious forms of bow-leg by massage and passive and resistance exercises of the legs during the early months of life, before the infant makes any attempt at walking. Any concomitant rickety condition however must be treated on orthodox lines.

Curative. If rickets exists this underlying condition must be treated and corrected before the child is allowed to impose the weight of its body on the legs. In very severe cases appropriate splints must be supplied, which should be worn by night as well as by day, but removed at least once a day to allow of massage and resistance exercises for the legs.

Before the etiology of rickets was understood, I used to see many rickety infants going steadily downhill owing to the fact that they were immobilized in splints without any opportunity for exercise or massage. In all these cases the general hygienic principles as regards fresh air, sunlight, exercise, feeding, etc., should be observed. The question as to whether osteotomy or the wearing of irons should be resorted to must be left to the orthopædic surgeon.

Genu Valgum

(Knock Knee)

When for any reason the internal condyle of the femur or the lower end of the corresponding diaphysis is longer than usual, it interferes with the alignment between the thigh and tibia, and results in some degree of knock knee, which is only an exaggeration of a normal condition. It is almost invariably an acquired condition, and is due to an unequal distribution of body-weight on the two condyles, and subsequent cramping of the growing epiphyses on the outer side, with stretching of the internal ligament. This faulty distribution is caused by a straddling of the legs when the child begins to walk, in order to maintain equilibrium. Although it is commonly said by certain authorities that cases of knock knee occur in rickety children, my own personal experience is that rickets proper, as a rule, has very little

to do with the etiology, and that the real cause of *genu valgum* is some acquired condition of muscular and bodily debility which necessitates straddling of the legs when the child begins to walk.

Treatment.

Prophylactic. The preventive treatment of knock knee consists almost entirely in avoiding these faults in the hygienic management of the child which lead to debilitated states and muscular weakness. In this, as in many other allied conditions, opportunity for, and encouragement of, muscular development by appropriately devised exercises, combined with massage, is by far the surest means of preventing deformity. Even inexperienced nurses and mothers have endless opportunities for exercising the muscles of the legs of infants by means of resistance exercises, dancing on the lap, or allowing the child to make attempts at crawling, without resort to a specially organized system of exercises such as the Neumann Neurode. I have the greatest confidence in the latter system, and have seen many excellent results from it.

Curative Treatment. The curative treatment of this condition may be considered under three headings:

1. Expectant.
2. Mechanical.
3. Operative.

Expectant. The kind of treatment to be employed will depend largely on the age of the child. In all cases, however, any underlying condition of malnutrition or debility must be appropriately attended to by correct feeding, exercising, airing, clothing, and resting.

Manipulative procedures to correct the deformity are an important part of expectant treatment, and should be applied daily for a quarter of an hour. They should be carried out with energy and some force, but not so as to cause pain. The deformed limb should be forced into the correct position. If the child is old enough to ride a toy cycle or cycle horse, or use roller skates or a scooter, all these are valuable means of assisting in the cure.

Mechanical. This consists in applying one or other of the many braces or splints which are advocated by different authorities for maintaining the correct position of the limb; such treatment is only required in extreme cases.

Operative. The choice, if operative interference is regarded as necessary, lies between osteoclasis, linear osteotomy, or cuneiform osteotomy, and this choice must be left to the orthopædic surgeon.

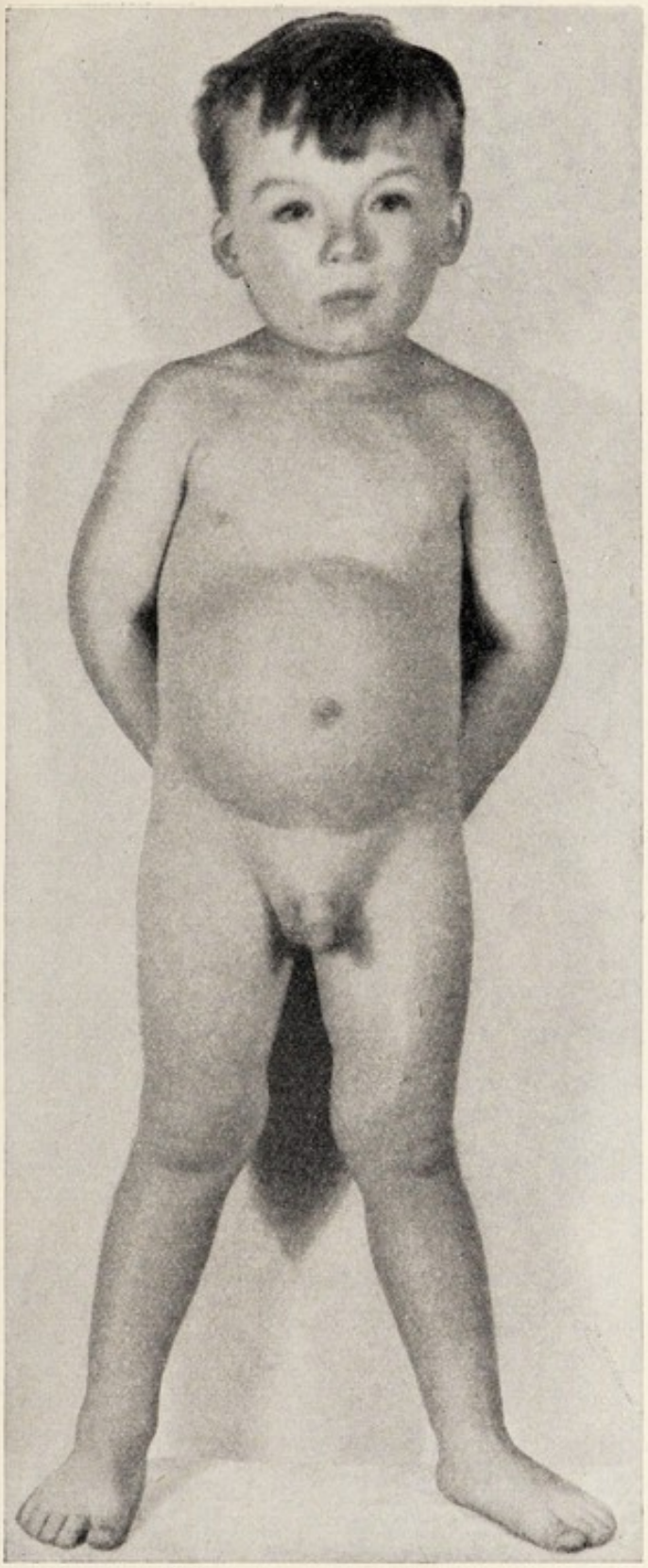


FIG. 37.—Child of 3 years, showing Protuberant Abdomen, Knock Knees and Flat Feet.

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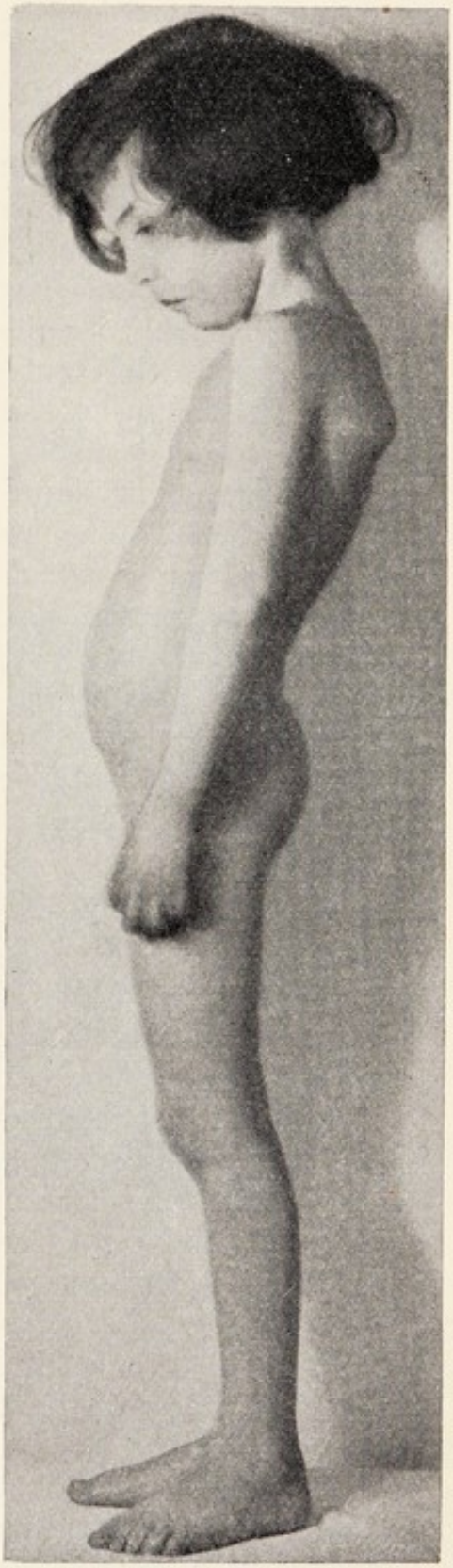

FIG. 38.—Child of 5 years, showing round shoulders, kyphosis lordosis and general slouch.

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Round Shoulders

This is a very common and disfiguring deformity of childhood. It is usually acquired, but is occasionally congenital in origin. When acquired, it generally develops in atonic and muscularly debilitated children from the habitual assumption of faulty positions in standing, sitting, or lying. The condition is frequently accompanied by poking of the head, lumbar lordosis, flat chest, pot belly, flat foot, and slouching attitude and gait.

Four quite different types have been described :

(1) The round back in which there is persistence of the general spinal kyphosis of infancy.

(2) The hollow round back in which there is a kyphosis of the dorsal spine associated with, and to some extent compensated by, an increased lordosis in the lumbar spine.

(3) The rounded upper back in which the backward curvature concerns the dorsal spine and is compensated for by lordosis of the lumbar spine.

(4) Flat back, in which the vertebral column is in alignment, but the shoulders are held forward, with " winging " of the scapulæ.

Treatment.

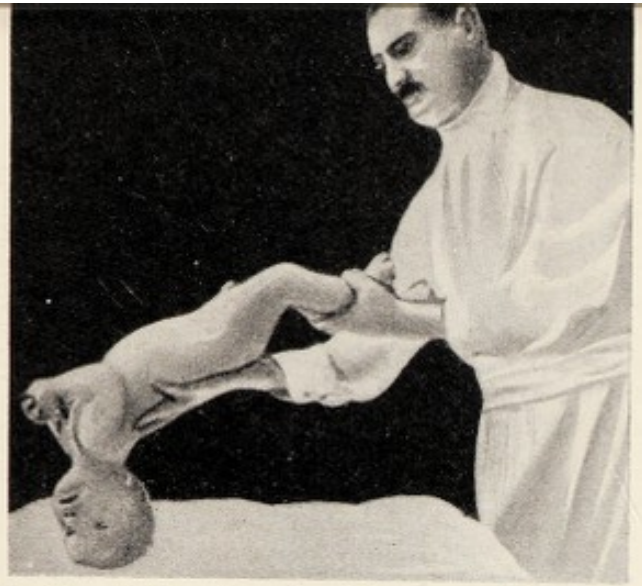
Prophylactic. The prevention of this deformity is far easier than its cure. It depends on :

(i) The avoidance of those faults of feeding and general management which lead to atonic, neurasthenic, and debilitated states. Although rickety children are often round shouldered, the deformity is not an essential element in the rickets syndrome, but it is symptomatic of a general condition of debility.

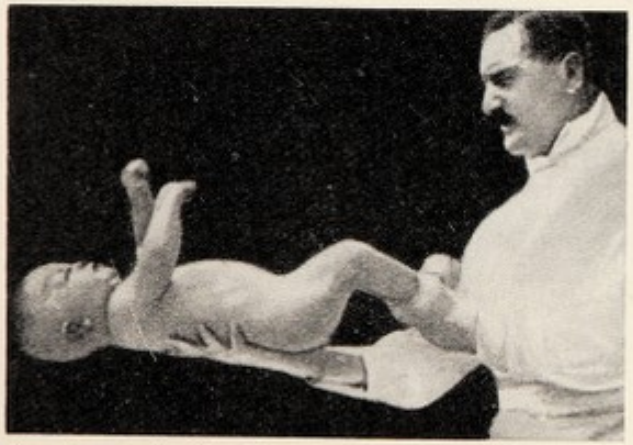
(ii) The prevention of errors of posture from short sight, heavy clothing, and faulty seating.

(iii) By securing the adequate development of the muscular system and particularly that of the shoulder girdle.

Special care must be taken in the case of infants who from any cause are late in sitting up, crawling, walking, etc., and who are debilitated by digestive or other forms of illness, to see that they do not assume faulty positions in sitting, standing, or lying down, and that the muscles are encouraged to develop by appropriate exercise. Babies are never too young to commence systematic muscular exercises of the right sort, such as kicking against resistance, pulling themselves up by their arms, or trying to turn over. In the Neumann-Neurode method such exercises are reduced to a regular system.



No. 1. Body relaxed and supported by right hand. A gentle pull on the legs causes the child to raise its head and upper part of the body until—



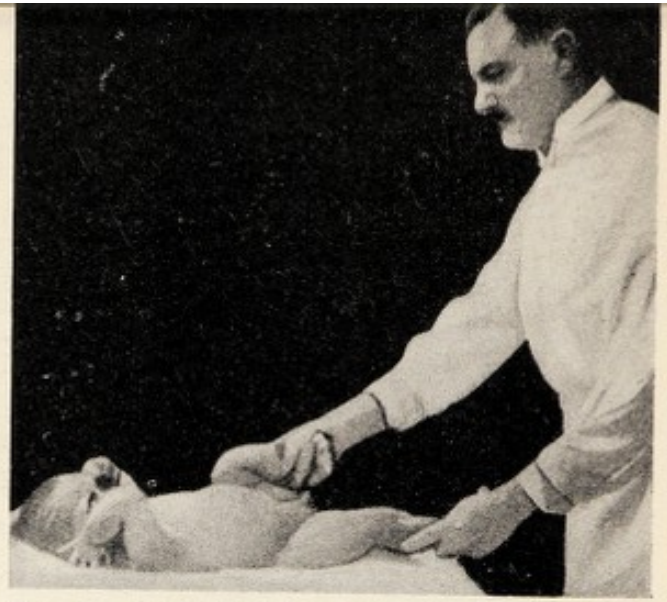
No. 2. —it finally reaches the horizontal position.



No. 3. The body is brought into the horizontal position by the action of the muscles of the back.



No. 4. The operator grasps the hands of the child who draws himself into the sitting position by bringing the arm muscles into operation.



No. 5. Corresponding exercise for the legs. The infant's feet push and pull in turn against resistance offered by the operator.

FIG. 39.—Neumann-Neurode Exercises for Infants.

The whole series of exercises, of which there are in all over twenty, have been devised by Major Neumann-Neurode of Berlin, and described by him in his booklet.

These illustrations are reproduced from *Mothercraft* (to which the author has contributed a chapter on Physical Development), by kind permission of the publishers, The Association of Maternity and Child Welfare Centres, 117, Piccadilly, London, W.1.

FIG. 40.—EXERCISES FOR GIRLS.



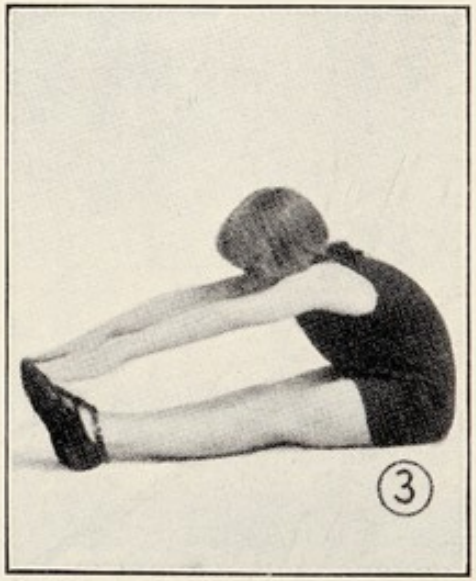
For legs and carriage of the body.

Place the hands on the head with tips of fingers meeting. Square the elbows, pressing them back as far as they will go. Raise the heels off the ground and lower body by allowing the knees to bend outwards. Carry out this movement slowly, then straighten out and lower heels. Repeat the movement slowly four times.



For the back and chest.

Sit on the floor with legs crossed and hands grasping feet. Stretch upwards as far as possible, pressing the head and upper part of the body backwards as far as the straightened arms will allow. Return to upright position, relaxing strain on arms. Repeat four times.



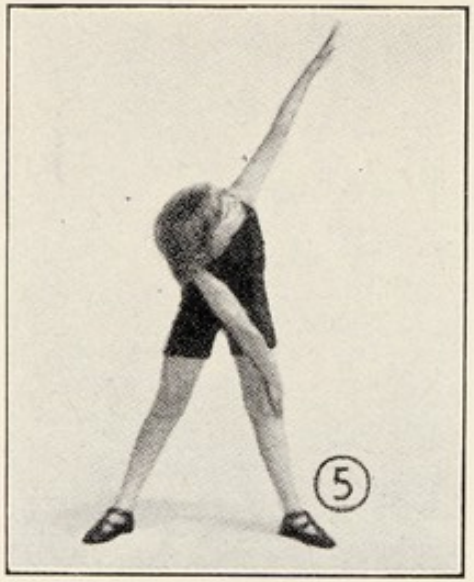
For the abdominal and back muscles, to increase flexibility of hips and to promote good respiration.

Sit on the floor with legs fully extended and toes pointed. Raise arms to full extent above the head, bend slowly forward and try to touch the toes with the fingers. Then raise arms to former position and straighten back. Repeat four times, taking deep inspirations while bending forward and deep expirations while bending back.



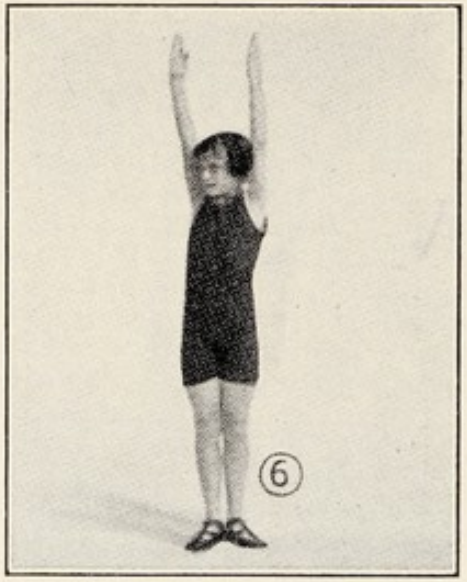
To improve the carriage.

Raise the arms above the head, and the left knee above the level of the left hip. Point toe downwards, then try to raise the right heel off the ground and maintain balance. Pause, and return to standing position; and then repeat the same movement with the other leg. Repeat the exercise four times on each leg.



To strengthen abdominal and back muscles.

Straddle the legs widely apart. Rotate body to left at the hips, with the left arm fully extended above the head, and right fully extended below the left knee. The eyes should be turned in the direction of the left hand. Now rotate the body in the opposite direction, bringing the left arm so as to touch the right knee, at the same time raising the right arm in the same way as the left arm was previously raised. Repeat this double movement three times.



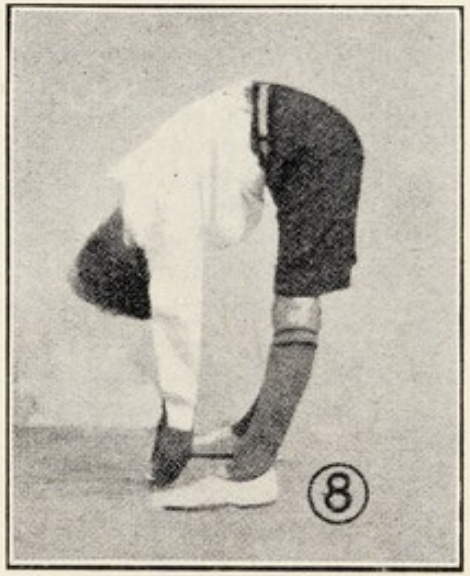
A breathing exercise.

Stand upright. Turn the body to the left by rotation at the hips and extend the arms forwards and upwards, breathing in deeply. Then turn the body so as to face squarely forwards and lower the arms to the sides, at the same time breathing outwards. Repeat the movement by turning the body to the right. Repeat these movements three times.

FIG. 41.—EXERCISES FOR BOYS.



Stand upright, bend the arms with elbows turned squarely outward, with tips of fingers on shoulders, at the same time going down as far as possible by bending the knees and raising the heels off the ground. While in this position, take three hops forward and then three backwards, preserving balance. Then lower heels, straighten out the knees, and rest. Repeat twice, with rests in between.



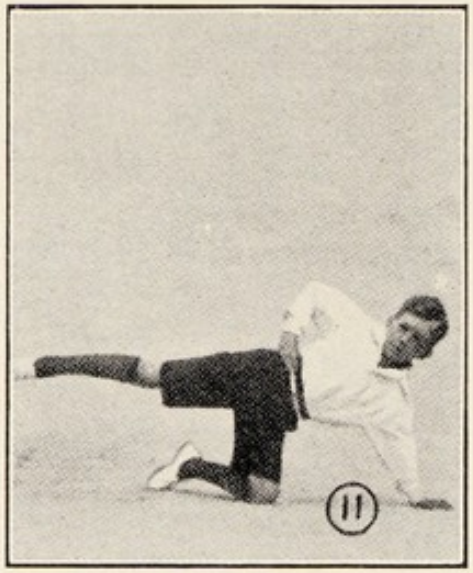
Straddle legs. Stretch arms above head, then forward, keeping knees straight, until the finger tips touch the floor. Breathe out during this movement. Now straighten out, raise arms above the head, breathing in during this movement. Repeat four times.



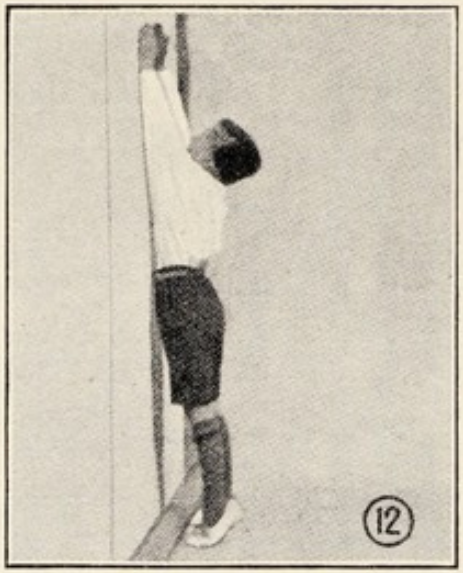
Place hands on hips and lunge foot forward, leaning the body forward over left knee and the back straightened out in a line with the right leg, the head and shoulders being held well back. Pause, then bring the right leg up to the left. Stand upright, then lunge forward with the right foot. Repeat four times with each foot.



Raise heels, bend knees, and lower the body, placing the hands just in front of the feet separated by about the width of the shoulders, with the elbows just inside the knees. Now, kick both legs backwards (together) so as to straighten at the knees, and rest on the tips of the toes. With a jump bend knees and regain former position. Repeat this movement slowly six times.



Kneel on the left knee, placing the left hand on the ground just beyond the shoulder in line with the knee. Place right hand on right hip. Now raise right leg, pause a few seconds and lower the foot to the ground, repeat four times, raising the leg higher and higher each time. Then kneel on the right knee and repeat the exercise, raising the left leg. The knee of the raised leg should be kept straight, and the toe pointed.



Stand facing a wall, with toes three inches away from it. Stretch the arms above the head, resting them against the wall. Now rise on the toes, stretching upwards as much as possible, keeping the eyes on the hands. Keep stretching for a few seconds, then lower the heels and arms and rest for a few seconds. Repeat eight times.

FIGS. 40 and 41.—These illustrations are reproduced from *Mothercraft* (to which the author has contributed a chapter on Physical Development), by kind permission of the publishers, The Association of Maternity and Child Welfare Centres, 117, Piccadilly, London, W.1. They were originally devised by Mr. W. F. H. Dempster and published in the *Daily Express*.

Most of these exercises can be easily carried out by a trained operator, but they appear to inspire a certain amount of awe in those who are unaccustomed to them. The results are however extremely good, but they should be begun when the infants are under 6 months of age. After that age they are sometimes difficult to teach.

For older infants or young children, a different class of exercise must be devised. Simple trapeze exercises appear to be enjoyed by quite young children, and are valuable even in the case of babies under 1 year of age. Precautions however must be taken to see that the trapeze is hung low and a good mattress placed underneath in case the child should fall off. Some of the exercises illustrated in Figs. 40 and 41, supply useful varieties which can be employed with benefit in the case of intelligent children under 5 years of age.

Curative Treatment. The actual treatment of this condition will depend very largely on whether the deformity is flexible, resistant, or rigid.

Flexible Type. In this type in which the faulty posture can easily be corrected by manipulative procedure, no curative apparatus or surgical instrument of any kind is required, in fact, they are both actually harmful in that they deprive the hypotonic muscles of the exercise which is required for their recovery and development. In all these cases the ordinary principles of correct feeding and management must of course be observed. The child should not be allowed to assume faulty positions, while rest for the muscles must be provided between periods of exercise, during which the child may be allowed to lie flat on a suitable hard couch, bed or board. Massage of the muscles of the back and scapular region should be given regularly. Exercises which are suitable for the condition are as follows :

(1) Back Exercise. The child should stand with the body bent forward at the hips and fling the arms forward and upward with the elbows straight. A deep breath is taken as the arms are flung forward, and it is important that the back should be kept straight as the final position is assumed.

(2) Abdominal Exercise. The child should lie on his back and assume the sitting position with his hands behind his neck.

(3) Leg Exercises. The child should be taught to march somewhat after the fashion of the German military Goose Step, and at the same time hold a fairly large and heavy

object, such as a book or box, balanced on the crown of the head, and supported by the hands with the fingers on the top and the thumb underneath. The elbows must at the same time be pressed backwards so as to be in a line with the straightened back. By this means "winging" of the scapulæ will be corrected and they will be brought flat up against the thoracic wall with their vertebral borders in the same plane, parallel and close to the spine.

The excellent carriage of water-carriers and Covent Garden market porters who carry heavy weights balanced on their heads is due to the perfect posture necessitated by this somewhat difficult feat. Children with round shoulders should carry out these exercises with increasing head loads for about 10 minutes every day. I have seen most excellent results from this procedure alone, without any other form of remedial treatment.

Resistant Type. The rationale of treatment lies in overcoming the resistance by manipulation and stretching procedures. The spinal column is straightened out by massage, manipulation, and posture, and the shoulders are pressed forcibly backwards so as to stretch the shortened muscles of the shoulder girdle. When the required degree of flexibility has been secured by frequent repetition of this treatment, the procedures recommended for the flexible type may be substituted for it.

Rigid Type. In these cases some sort of apparatus is usually required. It may take the form of a fixed pelvic girdle with a light post or upright to which the shoulders are suitably strapped. A suitable belt may support the relaxed abdominal muscles. If this treatment meets with success it may be successively replaced by that recommended for the resistant and flexible types.

Scoliosis

This is a lateral deviation of a part or parts of the spinal column from its true vertical alignment. It may take the form of a dorsal deformity which can be temporarily corrected by manipulation or exercise, or it may be dependent on some structural intra-spinal defect, such as organic disease of the vertebral muscles or ligaments, or on some extra-spinal asymmetrical condition, such as wry-neck, pelvic obliquity, or unequal length of the legs.

The causation of the postural type is for the most part loss of, or want of, muscular tone, or actual muscular debility. It causes the child to assume faulty positions with stretching of certain muscles and ligaments, and shortening of others, so that finally the deformity becomes more or less permanent.

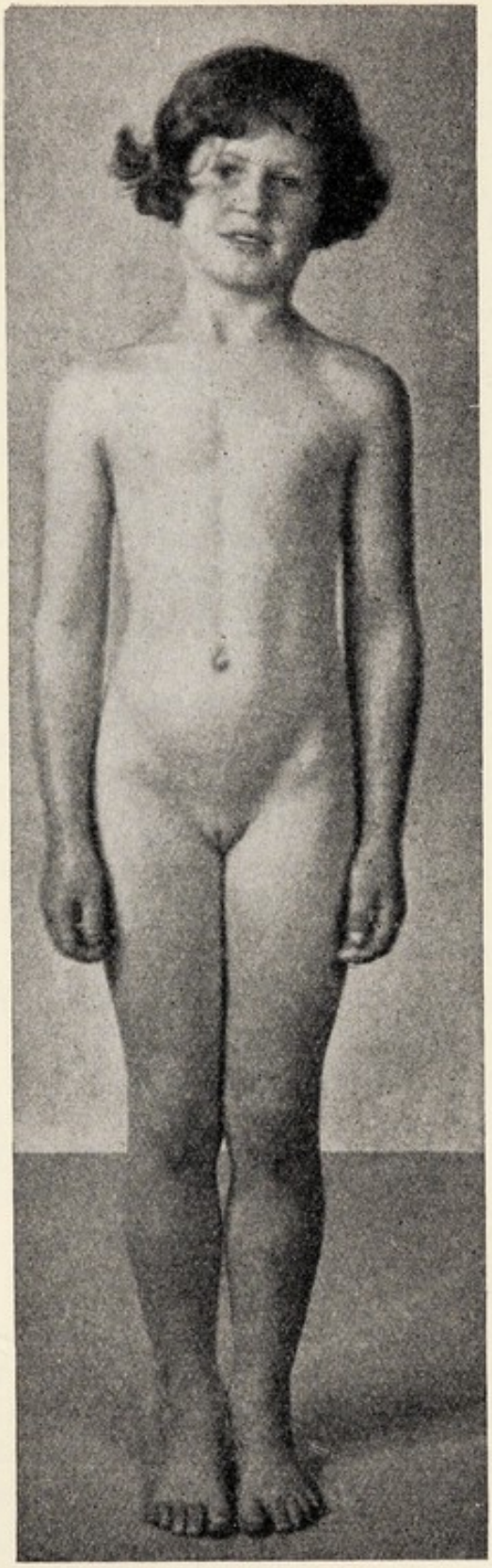


FIG. 42.—Normal Child.

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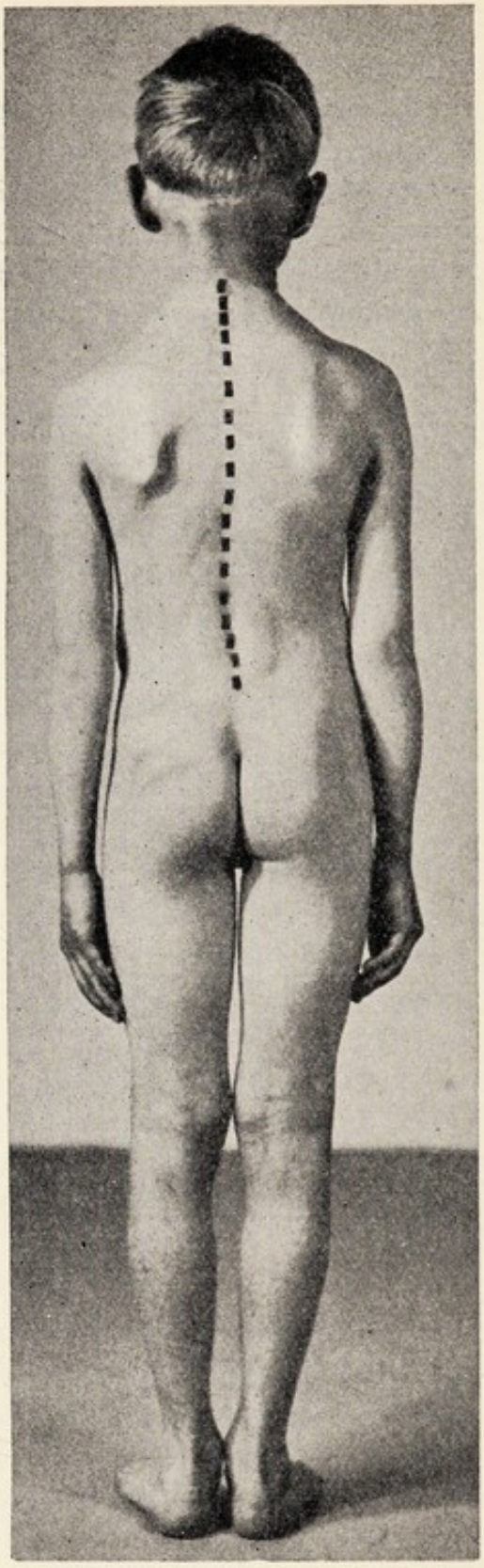

FIG. 43.—Child of 6 years, showing dropped shoulder and double compensatory Curves of the Spine.

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Treatment of the Postural Type. Prophylactic measures are the same as those described for preventing round shoulders (see page 624). Special attention must however be paid to considerations of adequate rest during periods of rapid growth, to pathological conditions of the eyes and ears, to any bodily asymmetries, and to the avoidance of all conditions of the environment which constitute causative or contributory factors to these disabilities. The restoration of flexibility to the spine by remedial exercises or massage, must be under the direction of an orthopædic surgeon.

Treatment of Structural Scoliosis. The prevention of this form of scoliosis and its treatment will depend on the special etiological factor on which it depends, and comprises surgical technicalities which are outside the scope of this book, and should be referred to a properly qualified orthopædic specialist.

Kyphosis

The word " Kyphosis " really means a hunchback, and represents an exaggeration of the cervico-dorsal curvature which normally exists in new-born infants, owing to a cramped position *in utero.* It occurs normally in infancy as part of a general bowing of the vertebral column. It also generally co-exists with round shoulders and is compensatory to a lordosis of the lumbar spine. Its more serious form is that which it takes in tuberculous diseases, or Pott's disease of the spine, in which the deformity is organic and is due to loss of substance in the bodies of certain of the affected vertebræ, which subsequently unite and become ankylosed at an acute angle (angular curvature of the spine).

Lordosis

This is a backward curvature of the vertebral column in which the convexity is directed forward. It is usually compensatory to some deformity of the legs, pelvis, or thorax, such for instance as double congenital dislocation of the hips. It is also compensatory to the cervico-dorsal kyphosis of muscular hypotonia (round shoulders). It is present in a peculiarly exaggerated form in cases of achondroplasia.

Treatment. *Prophylactic.* Like other deformities of the vertebral column, lordosis is mainly dependent on muscular debility, and therefore its prevention must depend on the avoidance of chronic conditions of malnutrition due to infective diseases or errors of feeding and general management which conduce to the hypotonia of muscle. The systematic development during early infancy of the muscles which support the vertebral column

by appropriate exercises such as the Neumann-Neurode, are prophylactic measures of extreme importance (see page 625).

Curative. The cure of this condition is mainly dependent on the treatment of the underlying deformities, or defects to which the lordosis is itself secondary. Tonic treatment of the debilitated state and thorough revision of the diet and general hygienic management are essential features. As in many other kindred conditions, rickets is usually present as an associated disorder, but this does not mean that it is the cause of the deformity, and the mere cure of rickets is often most disappointing in its results as far as lordosis is concerned. It is dependent on muscular hypotonia, which is not by any means an essential element in the rickety syndrome, but is due to quite different causes.

DEFORMITIES OF THE THORAX

There are a great many varieties of chest deformity, a few of which are congenital in origin, but most of which are acquired as the result of abnormal strains and stresses acting on bones which have been softened by rickets. The normal shape of the chest is due to the normal traction of the respiratory and other muscles on the bones which make up the thoracic box, but when from weakness, paralysis, or over-action of these muscles the normal balance is disturbed, the shape of the chest will be altered accordingly, as for instance in the case of paralysis in Werdnig-Hoffman's disease, or in obstruction to the entry of air into the lungs, caused by enlarged tonsils and adenoids. Quite independently of abnormal muscular action, softness of the bones due to rickets has the same effect. The bones themselves, as well as the cavity which they enclose, become distorted in shape. The most common variety of malformation of the thorax is asymmetry of its two sides owing to rotation of part of the vertebral column by lateral curvature.

Pigeon Chest

This deformity is due to an increase in the antero-posterior diameter of the chest, and a decrease in its lateral dimension, so that the sternum is forced forward in the characteristic manner which gives to it the name of "Pigeon Chest." It is nearly always an acquired deformity, although a tendency to its acquisition appears to run in certain families. It is due primarily to softness of bone, but partly also to the calling into play of the extraordinary muscles of respiration, when there is obstruction

of the entry of air by enlarged tonsils or adenoids, or when there is much coughing.

Treatment. *Prophylactic.* Preventive measures consist chiefly in the avoidance of all those factors in the feeding and general management which conduce to rickets. Secondarily, in the removal of any existing obstruction to the entry of air, such as are caused by tonsils or adenoids, and in the treatment of cough.

Curative. Attention must be paid to the treatment of the cause, or underlying condition, that is to say, by the cure of rickets, the removal of tonsils and the relief of cough by appropriate treatment. None of these however will actually cure the deformity when once it has developed, although they may prevent it from becoming more pronounced. The only real cure for pigeon chest is the application of a surgical instrument, or the wearing of a cuirass or truss, which will mould the developing chest into a normal shape by restraining its expansion in the antero-posterior direction, while freely allowing a side-to-side or lateral expansion. The apparatus shown in Figs. 33 and 34 (page 596) has in my experience proved extremely useful, and has effected a complete cure in many cases. The treatment however must be persevered with for a very long time, so as to allow the thorax time to remodel itself on the desired lines. Without growth, no apparatus can force a mal-formed thorax into a correct shape. The older the child, the longer must the treatment be persisted in, and in the case of a baby 1 year old it may be necessary for the instrument to be worn for a whole year, while for a child 3 years of age a cure will take 2 years or more. In the end, however, it is uniformly successful, as long as the instrument is properly made and fits correctly. The illustrations given on page 596 show the apparatus in position, and the effect of treatment.

Harrison's Groove or Sulcus

This very common deformity in rickety children consists in a deep grooving of the thorax which almost completely encircles its anterior and lateral aspects. It is situated just above the level of the insertion of the diaphragm, and may cause depression of the 5th, 6th, 7th, and 8th costal arch. It is due to the inward pull of the diaphragm which is exercised on ribs which have been softened by the rickety process and offer little resistance to the strain. It is particularly liable to occur in rickety children when there co-exists any obstruction to the entry of air, or when a chronic cough complicates the condition. The apparent depth of the sulcus is generally accentuated by an outward flare of the lower ribs, which are prevented from sharing in the depression

by the support afforded by the enlarged liver and distended intestines, which are common accompaniments of the rickety condition.

Treatment. *Prophylactic.* Prevention consists in the treatment of the underlying rickety condition, and in the correction of the faulty feeding which leads to the flatulent distension of the intestines, and enlargement of the liver. Any concomitant cough or obstruction to the entry of air into the lungs must be dealt with on appropriate lines.

Curative. A cure of this condition is practically impossible, but the deformity may be prevented from becoming more pronounced by resort to the procedures which have been recommended for its prophylaxis.

CHAPTER XVIII

DISEASES OF THE EYES AND EARS

DISEASES OF THE EYES

DISEASES OF THE EYELIDS

Congenital Defects

The eyelids are subject to many congenital defects, such as epicanthus, or a redundancy of the crescentic folds of skin which lie between the bridge of the nose and the inner angle of the eye. This condition which exists in a pronounced form in Mongols, and in the rare congenital defect known as hypertelorism, generally improves as growth proceeds, and needs no special treatment.

Ankyloblepharon. Ankyloblepharon, or adhesion to one another of the margins of the upper and lower lids requires surgical operation.

Coloboma. Coloboma, or a notch or gap in the upper lid, is a congenital defect of development which exposes the cornea to irritation and ulceration, and requires surgical repair.

Dischiasis. Dischiasis, or a double row of eyelashes, can be rectified by the slow and tedious extraction of the redundant hairs by the action of electrolysis.

Ectropion, or eversion of the eyelids, requires operation.

Entropion, or inversion of the lids, also requires operation.

Ptosis. This is due to the absence of, or defect in, the levator palpebral superiors, and may be improved by the plastic operation of shortening the lid or grafting the head of the superior-rectus muscle into the eyelid.

Symblepharon. Symblepharon, or adhesion of the lids to the eyeball, requires release by surgical means.

INFLAMMATION OF THE LIDS

Blepharitis

Blepharitis, or inflammation of the margins of the lids occurs in two forms in young children, either as a mild coating of the

edges of the lids with seborrhœic crusts, which is usually associated with a similar affection of the scalp and is due to a staphylococcic infection, or as a somewhat serious ulceration of the marginal zones, usually the sequela of measles, or as part of a chronic conjunctivitis due to the Morax-Axenfeld bacillus.

Seborrhœic Type of Blepharitis.

Treatment. *Prophylactic.* Early treatment of seborrhœic conditions of the scalp or neighbourhood, as described on page 508.

Curative. This consists in frequent swabbing of the affected edges of the eyelids with a 2 per cent solution of bicarbonate of soda, and the application of golden ointment (yellow mercuric oxide ointment) to their margins.

Ulcerative Blepharitis.

This serious type of blepharitis is sufficiently explained by its title " Ulcerative." The eyelids should be painted daily with a 10 per cent solution of protargol, and frequently bathed with a 2 per cent solution of bicarbonate of soda, after which golden ointment should be applied to the lids. In intractable cases specific treatment has been found of service, but in view of the protean nature of the bacterial flora in these cases, the precise nature of the inflammation should be investigated by ordinary bacteriological means before any attempt is made to apply vaccine therapeusis. If available, an autogenous is preferable to a stock vaccine, but the latter is probably better than none at all. If a stock vaccine is employed, it should consist of 500 millions of both the staphylococcus aureus and the bacillus Morax-Axenfeld per c.c. One-third of a cubic centimetre of this vaccine should be injected locally into each eyelid, and one-third of a cubic centimetre subcutaneously into the arm. These injections, which should be repeated every 14 days, are usually followed by a somewhat violent local reaction, which in its turn is succeeded by an improvement in the lids themselves.

Styes

Styes occur on the eyelids in two forms :

(1) The External stye (Hordeolum externum) in which there is suppuration of the glands of Zeiss on the margin of the lids.

(2) The Internal stye (Hordeolum internum) in which the lachrymal or Meibomian glands are involved.

(1) External Styes.

Treatment. *Prophylactic.* Since this form of stye is very apt

to develop in series, or to recur at intervals, prevention is as important as cure, and consists in raising the resistance to infection in general, or to some particular organism if such can be discovered in the styes. If therefore, through environmental conditions, or ill-health, resistance has been reduced, preventive treatment consists in correcting these etiological factors. As regards the general health, regulation of the dietary on physiological lines is admittedly of importance, especially as regards the avoidance of over-feeding, or excess of proteins or carbohydrates. Hyperglycæmia as it exists in diabetic or glycosuric conditions, encourages the development of pyogenic organisms and consequently of furunculosis and styes. Intestinal toxæmia also, by impairing the general health, lowers resistance, and should be treated on the general lines already recommended for this condition by lactic acid organisms, such as lactobacilline, by sour milk, or by petroleum (Semprolin Emulsion) with phenolphthalein. Fresh yeast, or dried yeast preparations are also reputed to have almost a specific action on furunculosis, and they should certainly be given to children who suffer from recurrent styes. I generally give Yestamin tablets (see page 708) to the extent of three daily as a prophylactic procedure.

Curative. The general health should be attended to as advised under prophylaxis. A change of air is often of advantage, while sulphur (5 gr.) in the form of the old-fashioned brimstone and treacle, or as the confection (10 gr.) is often very efficacious, and better than the more generally employed calx sulphurata (sulphurated lime).

The intra-muscular injection of ½ c.c. of collosol manganese every other day for 10 days also has its advantages.

Local Treatment. This consists in the extraction of the eyelash involved. Hot fomentations will hasten the maturation of the abscess and a clean incision on the inner side of the eyelid will evacuate the pus and relieve the discomfort due to mechanical irritation.

Specific Treatment. As in the case of blepharitis, so with a succession of styes, local inoculation of the lids with an autogenous or stock vaccine often gives beneficial results. The details of the procedure are the same as those given for ulcerative blepharitis (page 638).

(2) Internal Styes: Lachrymal Abscesses (Meibomian glands).

The lachrymal or Meibomian glands which are situated at the external angle of the upper eyelids are occasionally the seats of

abscesses (dacryo-adenitis), and constitute a large variety of stye. They should be treated in exactly the same manner as described for the ordinary type of stye, special care being taken to open the abscess on the inner side of the lid. Cystic swelling of these glands occasionally takes place owing to occlusion of the ducts, and when this occurs the contained secretions may be evacuated without incision by judicious manual pressure.

Lachrymal Sac and Ducts

The lachrymal sac with its ducts by which tears are drained from the eye into the nose, is not infrequently occluded and thus becomes the seat of suppuration. Infection of the sac in such cases is due to extension from the nose and nasal duct upwards, or from the eye itself through the puncta and canaliculi downwards. When this accident occurs there is usually some redness and swelling over the area of the sac, and pus may exude on pressure from the puncta into the inner canthus of the eye. Under conditions of occlusion, whether due to developmental causes, or inflammation, there is an overflow of tears (epiphora) down the cheeks, giving rise to irritation and possibly eczema.

Treatment. *Prophylactic.* Apart from the treatment of the primary cause of the suppuration of the sac, such as inflammation of the eye (blepharitis, conjunctivitis), or of the nose (catarrhal inflammation, snuffles, etc.), little can be done to prevent inflammation of the lachrymal sac itself.

Curative. Frequent irrigation of the eye with boracic acid lotion, and complete emptying of the lachrymal sac by pressure with the fingers, is as a rule all that is needed to effect a cure, but in obstinate cases more energetic measures are necessary, and the sac must then be washed out by passing a fine cannula through the puncta, a somewhat delicate operation in infants and young children, and by freely syringing the whole of the drainage apparatus. The application of a 5 per cent argyrol solution occasionally to the eye itself helps to maintain aseptic conditions. In very intractable cases of suppuration of the sac, it may be necessary to remove it.

Eczema or soreness of the cheeks, due to epiphora or the overflow of tears, must be treated by smearing the skin with boracic ointment, or painting it with a protective coating of collodion or varnish (page 708).

Conjunctivitis

Inflammation of the conjunctiva can assume either an acute or a chronic form, or the former may gradually pass into the

latter stage. Phlyctenular conjunctivitis is a special variety which will receive independent description.

Acute Conjunctivitis.

In the acute form of conjunctivitis, the cause is usually either the Morax-Axenfeld bacillus, the Koch-Weeks bacillus, or the gonococcus, but it may be caused by quite a large number of other organisms, especially in new-born infants. In all cases the disease is extremely infectious and may occur in epidemic form in institutions, or over-crowded houses. Outbreaks of epidemic ophthalmia (Pink Eye or " Swimming-bath " conjunctivitis) are generally due to the Koch-Weeks bacillus, propagated by towels, sponges, water, etc. In Lying-in hospitals such epidemics are generally, but not always gonococcal. In all cases it is very desirable to determine the exact nature of the organism concerned in order that specific treatment may be applied.

Treatment. *Prophylactic.* Preventive measures consist in the avoidance of infected individuals and strict isolation and antiseptic treatment of those suffering from the disease. After exposure to any known source of infection the same prophylactic procedures as those advised in the case of new-born infants, namely, the instillation of one drop of a 1 per cent solution of nitrate of silver, or several drops of castor oil with acriflavine (1 in 1500) into the conjunctival sacs is justifiable and efficacious, as also is the frequent irrigation of the eye with boracic acid lotion.

Curative. This consists in the frequent washing away of the discharges with cold boracic acid lotion, and in smearing the free margin of the lids with boracic acid ointment, to prevent them sticking together, and in rubbing into the conjunctivæ a 5 per cent protargol or argyrol ointment. In the case of Morax-Axenfeld infection, sulphate of zinc is reputed to have almost a specific action, so that in such cases 1 grain of this salt should be added to each 3 ounces of the boracic acid lotion.

Chronic Conjunctivitis (Follicular Conjunctivitis).

The chronic forms of this disease often follow on the unsuccessful treatment of ophthalmia, secondary to measles, or the result of an acute infection with the Morax-Axenfeld bacillus, or the staphylococcus aureus. The serious and special form of chronic conjunctivitis, known as trachoma, is fortunately rare in this country since steps have been taken to segregate and isolate immigrant children affected with this form of ophthalmia.

Trachoma is characterized by the presence of follicular granulations in the upper fornices, thus contrasting with simple folliculitis in which the granulations are mainly in the lower fornices. It is exceedingly contagious and resistant to treatment.

Treatment of Simple Follicular Conjunctivitis.

Prophylactic. Prevention consists in the energetic treatment of all acute cases of conjunctivitis in the early stages in order that they may not develop into the chronic form. It also consists in the avoidance of all causes of eye-strain, the correction of errors of refraction, and the protection of the eyes from strong lights, or cold winds, by suitable glasses.

Curative. The cure consists in the removal of the existing causes and sources of irritation, such as errors of refraction, or exposure to strong light. Frequent irrigation of the eyes with boracic acid lotion, the application of golden ointment to the lids, and the occasional instillation of a few drops of a 1 per cent solution of nitrate of silver, will usually effect a cure.

If the Meibomian glands are themselves affected, their contents should be freely expressed by manipulation with the fingers, so that all purulent discharges may be evacuated. In Morax-Axenfeld cases 1 gr. sulphate of zinc should be added to each 3 oz. of boracic acid lotion, and used frequently. In staphylococcic cases vaccine therapy should be employed as directed under blepharitis (page 638).

Treatment of Trachoma.

Although this disease is rare in England, it is so serious when it does occur, that the details of treatment are here given.

Prophylactic. Since in this country the disease is chiefly confined to immigrants and Jews, although common in Central Europe, Egypt, and Arabia, all children coming from these parts of the world with weak eyes, or any form of purulent ophthalmia, should be regarded as suspect, and should be examined by an expert ophthalmologist.

Curative. There is no specific cure for this type of conjunctivitis, and it has been recently [1] pointed out that the bacteriology differs according to the country of origin, and that in certain cases a virus associated with intracellular inclusions may play an important part in the etiology.

Local Treatment. This consists in the same irrigation measures as described for the simple form of the disease, and in addition the follicular granulations of the upper lid, which are so characteristic of trachoma, require special treatment and eradication. This is best done by means of a pencil of solid carbon dioxide snow, which should be applied to the conjunctivæ of the everted lids with a suitable amount of pressure. The number of times

[1] *Medical Annual*, 1936, p. 133.

the treatment should be applied, and the amount of pressure exercised, can only be decided by an expert. A general anæsthetic is, of course, required for this delicate operation.

Phlyctenular Conjunctivitis.

The term " Phlyctenular " means consisting of little vesicles, and is derived from the word phlyctena (a bladder). The conjunctival phlyctenule is a small red eminence on the ocular conjunctiva, generally situated at the edge of the cornea, and sometimes encroaching on it. The vesicular elevation is highly vascularized by a tuft or leash of dilated vessels which spread out from it in a fan-like manner to the neighbouring conjunctiva. The epithelial covering of the phlyctenule generally gives way with resulting ulceration. The responsible, or at least associated organism is generally the Koch-Weeks bacillus, or the staphylococcus aureus, but not the tubercle bacillus, as was formerly believed, although very large and intractable phlyctenules may occasionally be associated with tuberculosis in other parts of the body and respond to anti-tuberculosis treatment. The recently expressed view that phlyctenular conjunctivitis is allergic in origin, is quite in accordance with many of the observed facts.

Treatment. *Prophylactic.* There can be no doubt that phlyctenular conjunctivitis occurs in conditions of debility and enfeebled health and consequently prophylaxis consists in observing all those hygienic principles connected with correct feeding, cleanly surroundings, ample supply of fresh air and sunlight, on which good health and resistance to infective diseases mainly depend. I have so frequently noticed the association of teething troubles, and more especially those arising from the eruption of the canine teeth, with corneal ulceration and phlyctenular conjunctivitis, that I cannot help thinking there is some association between the two conditions, either as " cause and effect," or as the result of some common etiological factor. The sedative treatment with bromide which allays so many of the symptoms of dentition, cannot have anything but a good effect in cases of phlyctenular conjunctivitis which coincide with teething troubles.

Curative. Attention to the general health by climatic, dietetic, and other means mentioned under prophylaxis, is equally important in the case of the cure. The old belief that phlyctenular conjunctivitis is of tuberculous origin, is no doubt largely founded on the experience that the application of the same therapeutic means is equally efficacious in both conditions. Cod-liver oil, which has deservedly won so great a reputation in the treatment of this condition, may in all probability owe its merits in this connection to the therapeutic properties of its contained vitamin

A, which has a definite prophylactic influence on the development and health of epithelial structures. At any rate, cod-liver oil should always be given in these cases; so also should the juice of citrous fruits, and vitamin B preparations.

The intra-muscular injection of gluconate of calcium ($\frac{1}{2}$ c.c. every 3rd day) is also of value. Should there be any evidence of a concomitant tuberculosis, on the assumption that allergy plays some part in the etiology, desensitization with tuberculin (0·000001 mg. as an initial dose) is a rational and justifiable experiment.

Local Treatment. This consists in keeping the eye as germ-free as is possible by the frequent use of mild antiseptic solutions such as boracic acid, or perchloride of mercury (1 in 5000). Excessive congestion, or vascular dilatation may be met by instilling a few drops of 1 in 1000 adrenalin into the conjunctival sac, but it must be remembered that the effects are very transitory, while phlyctenular conjunctivitis may pursue a very chronic course. A 2 per cent ointment of Pellidol (Bayer), promotes epithelial growth, and as such may hasten the healing of the damaged or ulcerated surface of the phlyctenule.

As the condition improves and the ulceration heals, the more stimulating golden ointment (Ung. Hydrarg. Ox. Flav.) is indicated.

Xerosis

(Xerophthalmia)

Xerosis (drying), which is properly speaking a variety of conjunctivitis, consists in the keratinization of the epithelium of the conjunctiva or cornea, possibly owing to a deficiency of the lachrymal secretions. If severe, or long continued, such deprivation of its natural lubricant may result in ulceration of the cornea and loss of sight. In its less severe forms it results in night blindness and some cloudiness of the cornea. In its primary form keratomalacia is essentially a disease of infancy and childhood, and is closely connected with deprivation of vitamin A. Secondary xerosis sometimes follows on cicatrization due to trachoma.

Treatment. *Prophylactic.* This consists in the provision of adequate supplies of animal fat, milk, butter, and cod-liver oil, or in giving vitamin A concentrates, or carotene.

Curative. This consists in intensive vitamin A therapy, in the form of cod-liver oil, halibut-liver oil, or carotene, combined also with other vitamins, such as the vitamin B complex and vitamin C.

Local Treatment. This depends on the protection of the eye from mechanical injuries, or damage ; in keeping the surfaces of the eye well lubricated with liquid petroleum or castor oil, fortified with some mild antiseptic. There is probably nothing better than castor oil with acriflavine (1 in 1500).

DISEASES OF THE CORNEA

Ulceration of the Cornea

(Corneitis : Superficial Keratitis)

Although it is not always possible to differentiate between a conjunctivitis which extends over the cornea from the surrounding parts and a primary inflammation of the cornea itself, nevertheless, ulceration of the cornea can exist independently without involvement of any of the neighbouring structures. The common causes of such ulcerations are injuries, pyogenic infections, and occasionally a herpetic form of corneitis accompanied with considerable pain and photophobia, which is clearly of nervous origin. As the result of deep ulceration, perforation may take place, and this may be complete or partial, resulting in dislocation of the lens or adherence to it. A general weakening of the cornea with anterior bulging is one of the results of extensive superficial keratitis, and subsequent cicatrization. This condition is known as anterior staphyloma.

Treatment. *Prophylactic.* This consists in attending to the general bodily health, and in the avoidance of all sources of injury or infection.

Curative. Curative treatment consists in keeping the child in a darkened room, or with the eyes bandaged, so as to exclude light ; in the application of hot boracic fomentations, and in the frequent irrigation of the eyes with boracic lotion. In all cases a few drops of a 1 per cent solution of atropine should be instilled into the conjunctival sac during the acute stages, at intervals of 3 to 4 hours. If the ulceration continues to spread, the edges of the erosions may be touched with pure carbolic, or a stick of lunar caustic. As this is a delicate operation it should only be attempted by an ophthalmologist.

If the responsible organism can be identified, specific vaccine treatment may be attempted. After the ulcerations are healed, golden ointment (Ung. Hydrarg. Ox. Flav.) should be inserted between the lids, and the eyeballs gently massaged.

Opacities of the Cornea

Opacities resulting from scar formation in cases of ophthalmia neonatorum, or other forms of ulceration of the cornea are for the most part beyond the range of cure, but in suitable cases of corneal opacities, successful operations have recently been carried out [1] by transplanting the corneæ of rabbits, or even human corneæ if such are available, and by suitable cases, is meant those in which there is a corneal opacity without any marked staphyloma, fairly normal anterior chamber, reasonable tolerance to light, and normal intra-ocular tension.

Staphylomata

Large anterior staphylomata, resulting from acute inflammation or ulceration of the cornea, and especially as a late result of ophthalmia neonatorum, give a good deal of trouble, owing to the irritation they afford by projecting between the eyelids, and thus interfering with complete closure. This often leads to nervous symptoms, and a general impairment of health. At the Sunshine Homes for Blind Babies, which are conducted under the auspices of the National Institute for the Blind, we have a good many children suffering from this disability, and also have considerable experience of the benefits which result from the amputation of the eyes in suitable cases. The argument that the removal of such sightless eyes will interfere with the development of the bony orbit and thus place the child at a disadvantage need carry little weight, for we have found that by the use of artificial shells, or eyes, which can be changed from time to time as growth proceeds, adequate development of the sockets can be ensured, with excellent results from the æsthetic and cosmetic point of view.

Interstitial Keratitis

This is a late symptom of congenital syphilis. It is rarely met with in children under 5 years of age. In this condition there is an inflammatory infiltration of the deeper layers of the cornea, giving it a " ground glass " appearance. It is invariably accompanied by irido-cyclitis, with depositions on the back of the cornea (keratitis punctata).

Treatment.

Prophylactic. This consists in the early and energetic treatment of the primary disease by anti-syphilitic measures, or if

[1] J. W. Tudor Thomas, " The Results of Corneal Transplantation," *Brit. Med. Journ.*, January 16, 1937, p. 114.

possible by the ante-natal treatment of the expectant mother. Interstitial keratitis never develops in properly treated cases of congenital syphilis.

Curative. In spite of the syphilitic origin of the disease specific treatment with mercuric, arsenical, and bismuth preparations is of little avail in established cases of interstitial keratitis. The general maintenance of the bodily health by constitutional and hygienic treatment, by means of good feeding, cod-liver oil, fresh air, etc., confers greater benefit.

Local Treatment. This consists in leeching and hot fomentations. If there is much pain or photophobia during the acute stages the eyes should be fomented with hot boracic lotion and bandaged; a few drops of a 1 per cent solution of atropine should also be instilled into the eyes at four-hourly intervals. Later on when this acute period has passed, gentle massage of the eyeballs after the insertion into the conjunctival sac of golden ointment, appears to assist in clearing up opacities, or in preventing fresh developments.

DISEASES OF THE IRIS

Apart from congenital deformities of the iris, of which there are several varieties, including coloboma, there are a few diseases of the iris in infants and young children which call for description. The chief amongst these is iritis.

Iritis

The main causes of iritis in children under 5 years of age are syphilis and tuberculosis.

Treatment. *Prophylactic.* Consists in the adoption of the measures recommended under their appropriate headings for syphilis (page 162) and tuberculosis (page 440).

Curative. The cure consists in the protection of the eyes from light by placing the child in a darkened room, or by bandaging the eyes. A few drops of a 1 per cent solution of atropine should be inserted into each eye, and if there is much pain or photophobia hot fomentations should be applied.

DISEASES OF THE CHOROID

Apart from choroiditis, there are few diseases of this part of the eye which require description.

Choroiditis

Like iritis, choroiditis is of either syphilitic or tuberculous origin. As a manifestation of congenital syphilis it appears quite early, generally during the first few weeks of life, but it is seldom diagnosed until the time of puberty. The tuberculous form is mainly of interest in that by means of its presence as shown by the ophthalmoscope, reliable proof is afforded of the existence of a miliary tuberculosis.

Treatment. *Prophylactic.* This consists in preventive measures against both of these primary diseases, or in the treatment of the mother during pregnancy.

Curative. For the syphilitic form, ordinary anti-luetic measures are indicated, while for the tuberculous form there is no known cure.

DISEASES OF THE LENS

The only common disease of the lens in children under 5 years, apart from developmental defects, is cataract, which is itself nearly always congenital.

Cataract

Cataract may be complete, or partial, and it may be accompanied by other congenital defects of development, especially by those affecting the nervous system and the mentality. Little is known about the causes, but the lamellary variety is due to some nutritional disturbance, while the anterior capsular variety is due to adhesion between it and a diseased cornea, and the disc-shaped variety to some developmental fault.

Treatment. *Prophylactic.* As far as prevention is concerned, little or nothing can be done in congenital cases, but for the lamellary variety early and successful treatment of the causative corneal inflammation will usually prevent the trouble. It has recently [1] been suggested that a deficiency of vitamin C may be an etiological factor in the development of cataract. If this is so, full supplies of orange-juice during pregnancy should have prophylactic value.

Curative. Unless the cataract is of sufficient size to lead one to suppose that the defect will materially interfere with vision,

[1] *Medical Annual*, 1936, p. 111.

no treatment is necessary, but if there is reason to believe that it may, the question has to be decided whether the lens should be needled, or optical iridectomy performed. The latter is the operation of election in these cases in which there is a dense but small central opacity in which vision is improved by dilatation with mydiatrics. The great majority of cases are however more suitable for needling, which usually has to be repeated several times. The age at which this operation should be carried out is between 9 and 12 months.

DISEASES OF THE RETINA

The common diseases of the retina in children are syphilitic retinitis, miliary tuberculosis, glioma, degeneration of the cerebral nerve cells (amaurotic family idiocy), optic atrophy, and papillœdema. None of these diseases, however, from the point of view either of prophylaxis or cure come within the province of the general practitioner. Cases should be referred for treatment to an expert ophthalmologist.

ERRORS OF REFRACTION

These consist of hypermetropia, myopia, and astigmatism.

Hypermetropia

(Long-sightedness)

This is a condition in which the antero-posterior diameter of the eye is unduly short, so that parallel rays or light from objects situated more than 6 metres distant from the eye are not brought to focus on the retina, with the consequence that the image is somewhat blurred. This is a normal condition at birth, but one which is usually corrected as growth proceeds. The results of a persistent hypermetropia are sufficiently serious to demand correction by any available means and at an early period of life, before its consequences have had time to take effect.

In conditions of hypermetropia, if the child tries to accommodate sufficiently to obtain a clearly defined image of the object he is looking at, the strain on the ciliary muscle causes nervous exhaustion and headache. On the other hand if he is unable to accommodate sufficiently, or makes no attempt to do so, there is a general blurring of the image to near objects and the child obtains a false impression of his surroundings, with consequent

inaccuracy of visual memory, and defective control of the finer muscular co-ordinations.

The cause of hypermetropia is either a congenital defect in the development of the eyeball, or of the refractive media. In babies and young children it is not possible to diagnose hypermetropia with any degree of accuracy except by retinoscopic methods. Its presence however may be suspected if there is persistent frowning, screwing up of the eyes, lachrymation, and redness of the margins of the lids. Further, the size of the eye as a whole, and especially the cornea, appears less than normal, while the anterior chamber is definitely shallow.

Treatment. *Prophylactic.* There is no known means of preventing hypermetropia, but its consequences may be mitigated by correction with suitable glasses, by which means the natural tendency to cure is also encouraged.

Curative. This consists in the partial or complete correction of the errors of refraction by the wearing of suitable glasses. Although there is a strong prejudice against infants or young children wearing glasses, as a matter of fact a child is never too young to wear them if the optical conditions warrant their use.

Myopia

(Short-sightedness)

This is practically always an acquired condition, and is due either to an increase in the antero-posterior diameter of the eyeball (axial-myopia), or to some alteration in the refractive indices of the media.

Among the more important causes of myopia is the excessive use of the accommodation muscles, which are brought into play in looking at near objects, in reading, writing, sewing, drawing, etc. The prolonged strain on the capsule of the eye caused by such occupations results in a stretching of the sclerotic, and a prolongation of the diameter of the eyeball. Although this condition, and its degree, can only be estimated accurately by retinoscopic methods, its existence may be surmised from persistent screwing-up of the eyes with dilatation of the pupils. Further, the myopic eye is large, and the anterior chamber deep.

Treatment. *Prophylactic.* Adequate lighting, proper sitting and desk accommodation so that the head can be kept in the upright position, and by the avoidance of excessive use of the eyes, in looking at near objects, are all important factors in pro-

phylaxis. Further, the general health should be attended to, since malnutrition of any kind, whether from bad feeding or from infections such as measles, or whooping-cough, is apt to cause a weakness and stretching of all fibrous structures, not excepting the sclerotics.

Curative. As in prophylaxis, so in the cure, long hours of study in reading, writing, drawing, etc., and close work of all kinds, should be avoided. The use of oral teaching and large-scale writing and drawing on the blackboard should be substituted for the ordinary school methods. Correction must be made of ocular defects by the use of concave glasses with which the child can see distinctly distant objects. The spectacles themselves should be without a rigid nose bridge, and should be kept in place by ear-pieces made of pliant material. No child is too young to wear glasses if the optical condition of the eye warrants their use. Attention to the general health is an important element in the treatment, and special care should be taken after acute illnesses such as measles and whooping cough.

With rapidly increasing myopia the eyes should be kept at rest for some months with atropine, and dark glasses should be worn until health is restored, and the degree of myopia has become stationary.

Astigmatism

This consists of inequality of the refractive media, which results in an imperfect definition of distant objects; a point of light for instance, will always appear star-shaped. The fault generally lies in the cornea, the curvatures of which are uneven. Sometimes, however, the lens itself is defective. Although an accurate diagnosis of the condition and its degree can only be established by retinoscopic methods, its existence may be suspected by the presence of persistent headache, and other symptoms of asthenopia. A child with any high degree of astigmatism looks sideways at objects and screws up his eyes so as to eliminate as far as possible gross errors of refraction and the blurring of the image.

The results of astigmatism, like those of hypermetropia and myopia, are eyestrain and headaches, inaccuracy of visual memory, and failure at field sports or games in which quick accommodation and clear definition of moving objects are required.

Treatment. *Prophylactic.* Since astigmatism is a congenital defect, the cause of which is not understood, there is no means at present available for its prevention.

Curative. The cure consists in full correction of the errors of refraction by means of cylindrical glasses for constant use.

Strabismus

(Squint)

Squint may be apparent or real: in circumstances of doubt, the question may be settled by observing whether the reflex of light thrown by an ophthalmoscopic mirror in a dark room on to the eye of a child who is looking straight ahead, is centrally situated on the cornea of the suspected eye. If it is, the squint is apparent and not real. There are other methods of settling the question, but in the case of infants and young children this is probably the simplest way.

Squints are usually classified as either concomitant or paralytic. In the case of the former, the movements of the eye in all directions are good. There is no diplopia and primary and secondary deviations are equal. Concomitant squint may be either convergent or divergent.

Concomitant Convergent Squint.

Squints of this character may be occasional or constant, or they may be alternating—that is to say, the squint may be first in one eye, and then in the other. The convergent type is the common variety met with in children, though it does not always become apparent until the child attains the age of 2 years. It may be associated with hypermetropia, congenital amblyopia, or absence of fusion sense. The squint becomes more pronounced in conditions of ill-health, and during teething.

Treatment. *Prophylactic.* There is no known means of preventing squints of this kind, unless errors of refraction can be detected and corrected before a squint develops. Nevertheless, vigilance in the detection of very slight degrees of squinting may lead to steps which can prevent them from becoming serious.

Curative. Since the use of the squinting eye is suppressed, or tends to be suppressed, attempts must be made by educational means to train the child to the use of both eyes equally, otherwise the squinting eye will have a permanent defect of vision (amblyopia ex-anopsia), and binocular or stereoscopic vision will become permanently impossible. The first essential in the treatment of all cases of squint is to ascertain whether there is any error of refraction in either the squinting or the non-squinting eye, or in both, and if such be discovered, to order full correction and the constant wearing of glasses. Some ophthalmic surgeons, however, prefer to delay the wearing of glasses until the child is 2 or 3 years old, and meanwhile to keep the eyes under atropine to relieve the strain of accommodation. In a certain proportion

of cases these simple expedients will cure the squint. The education of the squinting eye can however be begun at any age by covering up the good eye and compelling the child to use the one with defective vision. If this method is employed the sound eye should be covered up for 6 hours during the day, and as the defective eye improves by use, the time of covering up the sound eye may be gradually reduced. Fusion sense can be trained by means of various orthoptic methods, with the use of such instruments as the amblyoscope, cheiroscope, Withington drawing-board and stereoscope. Excellent results [1] have been obtained by expert teachers in specially equipped academies, who train children to carry out orthoptic exercises, some of which may subsequently be practised at home. The most favourable age for this method of treatment to be begun requires careful consideration; as a rule it is best not before the child is 5 or 6 years of age, but under certain circumstances they may be commenced as early as the 2nd or 3rd year.

Concomitant Divergent Squint.

This form of strabismus is not so common as the foregoing. It usually occurs in myopic children, and in those who are nervous and excitable; it is made worse by illness or dentition.

Treatment. *Prophylactic.* Nothing can be done in the way of prevention except to treat the nervousness and dentition by bromide or other suitable sedatives.

Curative. The full correction by glasses, which should be worn constantly, and by orthoptic exercises.

Paralytic Squint.

This variety of strabismus occasionally occurs in infants and young children, and is generally due to paralysis of the external rectus. The paralysis may be due to the use of forceps at birth, or some congenital defect in the development of the nerve. It occasionally occurs during whooping-cough. It is always accompanied by diplopia. Secondary deviation is greater than primary. Low degrees of muscular defect often cause no symptoms.

Treatment. Little can be done for this condition, but as a rule the symptoms are not severe. Some of its more pronounced disadvantages, however, may be overcome by the use of prisms, and very occasionally by surgical operation.

[1] Sheila Mayou, "Principles of Orthoptic Training," *Brit. Jour. Ophthalmology*, June, 1936.

DISEASES OF THE EARS

CONGENITAL DEFECTS AND ANOMALIES OF DEVELOPMENT

The ears are very commonly the seat of developmental defects, among which must be included accessory auricles, rudimentary auricles (microtia), auricular fistulæ, preauricular tubercles, stenosis of the meatus, and absence of labyrinth, most of which are due to some fault of development in the 1st and 2nd branchial arches, or in the pharyngeal cleft between. Very little can be done for any of these abnormalities, except plastic operations.

Congenital microtia is as a rule accompanied by complete stenosis of the external auditory meatus, and is beyond treatment. Other examples of atresia of the meatus require operation, provided that the labyrinth is normally developed.

Outstanding ears, one of the commonest deformities of the auditory apparatus, are however an exception to this general rule, and should be treated, as they often cause great concern to parents, and adversely prejudice the child's chances in life.

Outstanding Ears

Treatment. *Prophylactic.* None.

Curative. A light network or lace cap should be worn constantly, with ear-flaps which are kept in position by tapes which



[*Bell, Son & Croyden.*

FIG. 44.—Ear cap for prominent ear. Nurse Collins pattern.

are tied under the chin and correct the deformity. In very bad cases a plastic operation is necessary, which consists in excising a wedge-shaped piece of cartilage at the base of the ear

and retaining the latter in a position closely approximated to the side of the head by a suitable cap or bandage for some weeks after the operation.

ACQUIRED DISEASES OF THE EXTERNAL EARS

The Pinna

The commonest diseases of this part of the ear are :

1. Hæmatoma. 2. Perichondritis. 3. Inflammation.

1. Hæmatoma of the pinna is not a very common accident. It is generally due to trauma, but may be a symptom of scurvy, or other hæmorrhagic disease, though no doubt in these cases there is also some determining factor of injury. I have twice met with cases in infants which have been due to scurvy, but in each case there was, I think, some additional element of trauma.



FIG. 45.—Haematoma of pinna due to infantile scurvy.

Treatment. *Prophylactic.* None.

Curative. Owing to defective conditions for absorption, a spontaneous cure must not be expected, and the fluid contents of the hæmatoma must be evacuated by aspiration, or by open incision under strict antiseptic precautions. In the case of scurvy there is some possibility of spontaneous absorption, provided the anti-scorbutic treatment is pursued vigorously, and the effusion is not too large.

2. Perichondritis. This may be one of the results of septic involvement of an unabsorbed hæmatoma. It may also occur as a sequela of smallpox, typhoid, or an operation.

Treatment. *Prophylactic.* This depends on the successful handling of an existing hæmatoma, or on the treatment of inflammatory conditions of the pinna by fomentation and other means before they reach the stage of suppuration.

Curative. This consists in free excision, and evacuation of any contained effusion.

3. Inflammation. The pinna is subject to the same forms of inflammation or dermatitis as the neighbouring parts of the skin, such for instance as erysipelas, seborrhœa, eczema, impetigo : it is also liable to become the seat of chilblains.

Treatment. *Prophylactic and Curative.* This is the same as that described elsewhere under the appropriate heading.

DISEASES OF EXTERNAL AUDITORY MEATUS

Inflammations

Mild inflammatory conditions of the external meatus are exceedingly common in infants and young children, mainly I think owing to the somewhat unnecessary but common practice of attempting to keep the passage clean and free from wax by ablutionary methods. A little wax in the ear can do no harm unless it forms an actual plug, when it can be removed by syringing, as described on page 658, but constant washing of the ears with soap and water, and cleaning them out by screwing into the meatus little pencils of cotton-wool or the corner of a towel, is apt to macerate the epithelial lining, or cause mechanical injury. Infants prone to eczema, or who otherwise have vulnerable skins, are specially liable to some form of dermatitis of the meatus, so are those suffering from otorrhœa, or the presence of foreign bodies in the meatus.

Treatment. *Prophylactic.* This consists in the avoidance of mechanical injury of the epithelium of the meatus, and the macerating effects of water. It also consists in the appropriate treatment of otorrhœa if such exists, and in the removal of foreign bodies.

Curative. In cases of inflammation of the external auditory meatus the common practice of syringing the ears with boracic lotion, or solutions of peroxide of hydrogen, or the insufflation of antiseptic powders, often does more harm than good, by causing or keeping up irritation of the skin. Maintaining the passage as dry as possible by the dehydration method of instilling a few drops of rectified spirit and lightly plugging the meatus with

cotton-wool, is in my experience a wiser course of proceeding. My predilection for tannic acid as an application to delicate and inflamed skin surfaces, extends to the treatment of inflammatory conditions of the meatus. The instillation of a few drops of a 10 per cent alcoholic solution of tannic acid into the meatus at intervals of a few days has an excellent dehydrating and hardening effect on the epithelium.

Furunculosis of the External Auditory Meatus

A boil in this situation occurs occasionally as a part of a general furunculosis, but more often as an isolated staphylococcic infection of a hair follicle, or ceruminous gland. This condition usually gives a good deal of pain, and the inflammatory swelling may completely occlude the meatus or extend to the mastoid region, giving rise to a suspicion of mastoid disease. Mastoid disease is however seldom accompanied by the same pain on pressure or traction of the tragus or pinna as is experienced in the case of a boil.

Treatment.

Prophylactic. None other than that which applies to furunculosis in general.

Curative. In the early stages before the boil is ripe for incision, the external application of heat by means of a hot-water bottle, or an electric lamp wrapped round with lint and placed in juxtaposition to the ear promotes maturation. Fomentations are not indicated as they lead to maceration of the skin and subsequent desquamation. When ripe, the boil should be opened and its contents evacuated, after which a few drops of an alcoholic solution of thymol (2 per cent) should be instilled into the ear.

For recurrent furunculosis specific treatment by vaccines is indicated. A yeast preparation (15 gr. Yestamin) may also be given three times a day, and has a definitely prophylactic influence.

Herpes of the External Auditory Meatus

This somewhat rare condition in children gives rise, when it occurs, to a great deal of pain, and may be mistaken for middle ear disease. It is due to an involvement of the geniculate ganglion or the sensory fibres of the facial nerve, and may be accompanied by facial paralysis. Otoscopic examination shows a group of vesicles on the tympanic membrane or neighbouring parts.

Treatment. *Prophylactic.* None.

Curative. The general treatment is the same as that of herpes in other situations, that is to say, by the giving of anodynes or

analgesics, such as phenacetin (gr. 1), morphia (gr. $\frac{1}{60}$), or Cibalgin ($\frac{1}{4}$ tablet).

The local treatment consists in the application of external heat.

Wax in the External Auditory Meatus

Wax plugs represent an accumulation of the secretion of the ceruminous glands; sometimes if particularly hard they become impacted in the meatus, a condition which is known as *keratosis obdurans*. In such cases the outer surface of the plug is usually coated with inspissated epithelium; and may cause pressure symptoms, deafness, and vertigo. Its removal may cause a good deal of trouble.

Treatment. *Prophylactic.* This consists in the avoidance of water in the ear, for washing or other purposes, but in the occasional syringing of the meatus if a plug is noticed to be forming.

Curative. As a rule plugs of wax, unless they are very large, and hard, can be removed by syringing after 24 hours' softening with oil dropped into the ear and retained in the canal by a pledget of cotton-wool soaked in water. In syringing, the stream of water should be directed to the back of the meatus, so that it can penetrate between the plug and the posterior wall, and thus dislodge it. As this procedure causes some little discomfort, it is not easy to apply it in the case of infants over 1 year of age, who cannot be retained in the required position without using a considerable degree of force. The use of forceps, hooks, or other instruments for removing plugs of wax must be employed with great care, lest a sudden movement on the part of the child should inflict damage on the mucous membrane, or the tympanic membrane itself. An anæsthetic may be required.

Foreign Bodies in the Meatus

Various objects, such as beads, buttons, beans, and seeds, etc., may be inserted by children into their ears, and later become impacted owing to swelling or other causes, and thus give rise to symptoms such as those described above in the case of plugs of wax.

Treatment. *Prophylactic.* None, except keeping a careful watch over children who are disposed to practices of the above kind.

Curative. The same as that described above for the removal of plugs of wax. If an anæsthetic is given and instruments are used, a good light is essential.

DISEASES OF THE TYMPANIC MEMBRANE

Rupture of the Membrane

This accident may happen from the insertion of hairpins, pencils, or sticks into the meatus in trying to dislodge wax or foreign bodies, or to allay irritation. It has happened before now from boxing a child's ears, from loud noises, from explosions, or from fractures of the base of the skull.

There is deafness, or impaired hearing on the side of the injury, and generally some blood in the meatus, while a rent in the membrane itself may be visible on otoscopic examination.

Treatment. *Prophylactic.* The avoidance of such possible sources of rupture as are mentioned above.

Curative. No active steps should be taken to repair the damage, but the meatus may be dried and temporarily plugged with a small pledget of boracic wool lightly inserted into the orifice. Should suppuration supervene it must be treated as described under acute otitis media (page 661). The mobility of the membrane is sometimes impaired later owing to thickening, and if this is so, it should be treated by gentle inflation of the middle ear by the Politzer method.

DISEASES OF THE MIDDLE EAR

Otitis Media

It is quite probable that the middle ear of young babies always contains some exudate of clear serum or mucus : at any rate, I have never yet seen a dry middle ear in a baby under 6 months of age, when I have had an opportunity of inspecting the interior. This wet condition does not imply however that there is necessarily any inflammation of the lining membrane, but infection can very easily occur by extension through the eustachian tube, especially in unhealthy or catarrhal conditions of the naso-pharynx, such as occur in the specific fevers, influenza, tonsillitis, and the common cold. In septic conditions in infants, infection of the middle ear and extension to the mastoid cells is extremely common. At The Infants Hospital we made a regular practice of opening up the middle ear and the mastoid cells in all cases which came to post-mortem, and we almost invariably found that in conditions of D. and V. as well as in all septic and septicæmic conditions, the middle ear and the mastoids were full of pus.

The path of infection in such cases may be the eustachian tube, but most generally, I believe, it follows the blood-stream. Cavities

such as the middle ear and the cells of the mastoid process are extremely ill-provided with means of defence against infection, and provide excellent breeding grounds for bacteria.

Acute Otitis Media.

It is customary to recognize two forms of otitis media, one, catarrhal—the other, suppurative—a classification which possibly represents a distinction without a difference.

In all cases of inflammation of the middle ear there is pain, restlessness, crying, pyrexia, and deafness. On otoscopic examination the membrane is usually found to have lost its lustre, to be red, and injected with a bulging most prominently in the posterior segment. The condition must be distinguished from a boil in the external meatus, from herpes, and from teething.

Treatment.

Prophylactic. The most important means of preventing otitis media, whether acute or chronic, is the maintenance of a clean and healthy condition of the naso-pharynx. Adenoid vegetations in the naso-pharynx are liable to obstruct the orifices of the eustachian tubes, and thus interfere with the normal ventilation and drainage of the middle ear. Blocking of this passage leads to absorption of the residual air in the middle ear, and depression of the tympanic membrane under the influence of atmospheric pressure. The partial vacuum in the middle ear, caused by the absorption of air, leads to filling of this cavity with a serous or mucous exudate, which constitutes an excellent culture medium for bacteria. The prophylactic treatment of otitis media is therefore to a very large extent the same as that for the prevention of adenoids, and consists in raising the resistance to catarrhal and other inflammations by appropriate hygienic measures, and includes good feeding, ample supply of vitamins, and the securing of good ventilation of the naso-pharynx by nasal breathing. The avoidance of exposure to infection, and the maintenance of a cool atmosphere in both living and sleeping rooms are further precautions which should be observed.

The removal of accumulations of mucus from the back of the nose in babies should be effected by the routine douching of the nasal chambers with a mild antiseptic lotion such as glycothymoline or lotio thymolis (page 704). It is often claimed that nasal douching is liable to cause aspiration or forcing of infected material from the pharynx upwards into the eustachian tubes, and thence into the middle ear, and that for this reason it should be avoided. I believe that these fears are entirely groundless; moreover, I feel convinced that by the routine adoption of this method I have prevented the necessity for many an operation

for the removal of adenoids. The routine douching of the nasal cavities must, however, be done carefully, not by forcible syringing, but by the gravitation method of allowing the lotion to flow along the floor of the nose and thus reach the naso-pharynx without entering the nasal sinuses. This can only be done by allowing the lotion to drop slowly into the nostrils, with the head placed in a horizontal position. The fluid sometimes returns by way of the other nostril, at others, it flows into the mouth, whence it can be swallowed, or if the child is old enough, discharged by spitting.

Curative.

Before Perforation. Great relief can be afforded to the pain of a commencing otitis media by instilling a few drops of warm glycerine containing carbolic acid and opium (page 706) into the meatus. External heat also serves the same purpose, and can be applied in the form of a dry bran poultice, an electric lamp, or a hot-water bottle.

Whether paracentesis (myringotomy) should be performed at this stage or not, is always a difficult question, and will depend on the amount of pain, the degree of bulging of the membrane, and on whether or not the inflammation has reached the stage of suppuration.

After Perforation. Whether the perforation is spontaneous or induced, the meatus should be lightly packed with a strip of antiseptic gauze which should be changed as soon as it becomes saturated. It is probably safer to rely on good drainage for the removal of the discharges, than to depend on syringing, or the instillation of antiseptic drops or lotions to effect this purpose.

Chronic Otitis Media.

The chronic form of otitis media is always suppurative, and is generally the sequel to an unsuccessfully treated acute case, owing to some constitutional disability, such as tuberculosis, syphilis, or wasting disease, or to some local condition, such as the existence of adenoids, which obstruct the eustachian orifices. An otoscopic examination should always be made to confirm the diagnosis, and the practitioner should beware of mistaking cases of weeping eczema of the meatus with copious discharge, for a genuine case of otorrhœa, and thus treating the condition wrongly.

Treatment.

Prophylactic. This consists in the early and energetic treatment of an acute otitis media, and by the removal of adenoids should such occlude the eustachian openings. All measures

which prevent the recurrence of colds or catarrhal infections of the naso-pharynx have prophylactic value.

Curative. In cases of chronic otitis media, special attention must be paid to the general health of the child, and a change of air, if possible, provided.

As regards local treatment, the prime essential is to ensure adequate drainage so as to prevent extension of the inflammatory processes to the mastoid cells, or to the meninges, or, indeed, the later complication of permanent deafness. The drainage of a practically closed cavity, such as that of the middle ear, from any point other than the lowest, must prove incomplete and unsatisfactory. In cases of otitis media the eustachian tube, the natural channel of drainage, is usually blocked up. Inflation of the middle ear by the Politzer method will help to keep the eustachian channel open, and to drive out residual discharges through the perforation in the membrane, but to carry out this operation every day for many weeks or months in chronic cases, is very tedious.

When a discharging ear has to be treated for more than one month, the chances of complete recovery, and the saving of hearing, are very problematical, especially if one has to rely upon the simple method of removal of the discharges through perforations in the tympanic membrane, or by natural drainage through the eustachian tube. My personal experience is that in chronic cases of this kind the best chance of effecting a cure lies in providing adequate drainage from the bottom of the tympanic chamber by a mastoid operation. After opening the mastoid cells this path of escape for the pus can be kept open by light plugging with gauze. I have never yet regretted advising this method of treatment.

Short of this operative procedure an effort should be made in protracted cases of otorrhœa to ensure the removal of the discharges by draining through the perforation in the membrane by inflation of the middle ear, as above described, and by facilitating the removal of discharges in the meatus by douching rather than by syringing. The discharges themselves and the irrigation fluid used for their removal have a macerating effect on the lining membrane of the meatus, which becomes sodden and unhealthy unless special precautions are taken to dry the channel after irrigation. I believe that the instillation of rectified spirit counteracts this tendency to some degree, and to a greater extent still if a 10 per cent solution of tannic acid in alcohol be substituted for the simple spirit. I do not advocate the insufflation of antiseptic powders as they tend to block up the meatus itself and to interfere with the rapid removal of discharges. Neither

do I think it necessary to add any antiseptic to the alcohol, although a mild antiseptic is probably indicated in the preliminary irrigation.

Granulations and Polypi

With long-continued otorrhœa there is a great tendency for the growth of exuberant granulations, or actual polypi, which represent granulations which have become covered with an epithelial coating. Both of these grow either at the edges of the perforation itself, from the wall of the tympanic cavity, or from the ossicles, and project through the perforation into the meatus. In rare cases the polypi may project externally beyond the meatus.

Treatment. *Prophylactic.* This consists in the early and energetic treatment of the otitis media itself.

Curative. The granulations should be cauterized with a stick of nitrate of silver. Polypi must be removed by snaring, or excision with specially devised scissors. The bleeding stump may be touched with some styptic such as perchloride of iron.

Cholesteatoma

Occasionally, owing to the persistence of otorrhœa the squamous epithelium which covers the membrane may extend over the edges of the perforation, desquamate, and become piled up within the middle ear owing to the absence of any convenient means of escape, in the same way that the squamous epithelium of the glans and prepuce becomes heaped up behind the corona in the form of smegma. As a consequence of this heaping up of desquamated epithelial cells, and their subsequent degeneration, a putty-like tumour gradually accumulates within the cavity, and may produce pressure symptoms, or ulceration of the bony walls of the cavity.

The diagnosis of this condition is by no means easy, but with labyrinthine, cerebral, or mastoid symptoms in a case of old-standing otorrhœa, the possibility of such a complication must not be lost sight of.

Treatment. *Prophylactic.* The early and energetic treatment of an existing otorrhœa.

Curative. The surgical removal of the tumour through the perforation, which if necessary must be enlarged for the purpose.

Mastoid Disease

The extension of the inflammation from the middle ear to that of the mastoid antrum is exceedingly common in children, and

almost inevitable if the inflammatory process has existed for more than 4 weeks, but it must be remembered that there is practically no mastoid process or antrum in infants under 3 months of age, and therefore the ordinary symptoms of a mastoiditis will not be recognizable in young infants.

The diagnosis in babies is difficult; as a rule there is little or no œdema, redness or tenderness behind the ears, as is usual in the case of older children. The most characteristic symptom in the case of young babies is redness or œdema of the meatus, generally quite near the membrane and on the posterior wall. I have on several occasions been able to diagnose the existence of a mastoiditis in young infants by this sign alone. Mastoiditis must be differentiated from furunculosis, acute inflammation of the external meatus, herpes, and troublesome dentition.

Treatment.

Prophylactic. The early and energetic treatment of an existing otitis media or otorrhœa.

Curative. The treatment of this condition includes that of the primary condition, such as otitis media, or cholesteatoma. With a definite mastoiditis, operation is always necessary, but even in cases of doubt the rule should always be observed to operate rather than to delay, for the operation itself is not a serious matter, whereas the possible complications which may result from want of giving exit to the pus may be very serious. Moreover, should the mastoid process itself prove to be free from involvement in the inflammatory process, the drainage which the operation affords will facilitate the cure of the otitis, with however this reservation, that involvement of the middle ear and of the mastoid cells is so frequently a terminal result of a septicæmia that little can be expected from such local relief in cases of this kind. I only remember recovery in one case of septicæmia in which the mastoid antrum was opened. If, however, in cases of septicæmia, an operation is decided upon, whatever the result, this step is probably justified because it may give the infant a sporting chance.

With regard to the operation itself, I am not in favour of any of the half-hearted methods which have from time to time been recommended, such as cutting down upon the bone without opening the mastoid process itself. The additional step of trephining the bone or by other means boring a hole, is a very small matter, and does not in the least prejudice the chance of a favourable issue in cases of uncomplicated otitis media, but rather promotes the chances of recovery, by affording adequate drainage to the main source of purulent discharge.

Complications of Otitis Media and Mastoiditis

Apart from those which have already been mentioned, the complications of both otitis media and mastoiditis consist for the most part in thrombosis of the sigmoid or other sinus and in labyrinthitis. The chief difficulty in rare cases of these kinds however lies in making an accurate diagnosis.

Thrombosis of the Sigmoid Sinus

In the early stages there is persistent headache and tenderness on percussion over the course of the sinus involved. There are also the ordinary symptoms of a septic infection. Later on with disintegration of the thrombus a general pyæmia results with possibly jugular phlebitis.

Treatment. *Prophylactic.* None, beyond the early treatment of the primary condition.

Curative. This consists in opening the sinus involved and plugging it with antiseptic gauze. Ligature of the jugular vein below the limits of the obvious phlebitis is a counsel of despair, but all the same should be undertaken.

Labyrinthitis

The symptoms are vertigo, with nausea and vomiting on movement. The child consequently remains absolutely motionless and in such a position that the involved labyrinth is lying upwards. Later on there are symptoms of nystagmus, facial paralysis, and of a general meningitis.

Apart from congenital diseases of the internal ear, there are few diseases of this part of the auditory apparatus commonly met with in infancy and childhood. When however there is disease of Corti's membrane, the condition is generally complicated by vertigo and tinnitus. Evidences of these symptoms are difficult to elicit in infants and young children, hence in their case the diagnosis is difficult. The acquired forms of the disease are generally due to trauma, syphilis, or meningitis.

Treatment. *Prophylactic.* Since the majority of cases are of congenital or hereditary origin, something can be done in the way of prevention by discouraging marriage among individuals with any familial tendency to deaf-mutism, or defective hearing.

Curative. Apart from the treatment of syphilis, if such is known to be a factor in the etiology, little can be expected from medical therapeusis, but a good deal in certain cases by the application of appropriate methods of training or education.

Deafness

Deafness, though easy to recognize in children who are of a talking age, is a defect which sometimes escapes recognition in young babies; indeed, congenital deafness is rarely recognized under the age of 3 months. From the point of view of treatment and prognosis it is important to know whether the deafness is congenital or acquired, also, whether it depends on defect in the external auditory meatus, the middle ear, the inner ear (organ of Corti or labyrinth), or is of cerebral origin. A wrong diagnosis of deafness is sometimes made in cases of congenital aphasia, in which it is supposed that the child is deaf simply because he is mute. Mentally defective infants with cerebral deafness are often at first regarded as merely deaf, because they pay no intelligent attention to sounds or noises, which they may hear, but to which they do not react.

In view of the great advances which have recently been made in the training of deaf-mutes, not only those in whom there is some residual hearing, but also in those in whom there is none, it makes it all the more important that some competent authority should make an accurate diagnosis of the nature, and of the degree of the deafness, as well as of its existence. Deafness due to defects in the sound-conducting mechanisms of the external and middle ear are comparatively easy to diagnose by naked eye and otoscopical examination.

The differences between deafness due to defects in the organ of Corti, or of the labyrinth, and of the auditory centres (cerebral deafness), is of fundamental importance, because cerebral deafness is nearly always associated with other brain defects, and the child is quite likely to be an ament, incapable of benefiting by teaching or training of any kind.

At The Infants Hospital we have recently opened a special department under the control of Mr. Philip Franklin, which is equipped with all the latest diagnostic and didactic apparatus for dealing with cases of deafness in children. At this Centre the cause and the degree of the deafness is investigated, and the most suitable methods of training or education determined.

CHAPTER XIX

CASUALTIES AND MINOR ACCIDENTS

Concussion

In connection with concussion the chief essential is to make a correct diagnosis, for it is likely to be confounded with more serious conditions such as cerebral hæmorrhage, fractures, compression, or with coma from external or internal causes which require drastic methods of treatment. The main evidences on which a diagnosis of concussion should rest are, firstly, the history of an accident, with the absence of any indications of fracture, hæmatoma, or pressure. Secondly, the immediate onset of symptoms, and the tendency for spontaneous improvement. On the other hand, with hæmorrhage, the symptoms are deferred and ingravescent in character. With a fracture of the base of the skull there is usually an escape of cerebro-spinal fluid from the ears, the presence of blood in cerebro-spinal fluid obtained by lumbar puncture, possibly facial paralysis, unequal pupils, or other localizing symptoms.

Treatment. After all alternative and more serious diagnoses have been excluded, the child should be put to bed in a darkened room, and encouraged to sleep. The following day the whole position should be reviewed, but if no further symptoms have supervened, the child should be allowed to resume his ordinary life, though if there are still any remaining indications of shock, the child must be kept quiet for the next few days, and given a few small doses of bromide.

Hæmorrhages

The treatment of severe hæmorrhages in which large blood-vessels are involved, is a surgical matter, and apart from " first-aid " procedures better left to be dealt with by those who have special qualifications, but speaking quite generally, hæmorrhages from surface wounds of mild degree should be treated by spraying thromboplastin on the damaged surfaces, and by moderate degrees of pressure applied through a suitable dressing and bandaging.

Special forms of hæmorrhage of a minor nature will be described in the following paragraphs.

Epistaxis.

Nose bleeding in young children is a common incident in general practice which has to be dealt with on the spot. As a rule the consequences are not serious, and the relief given to local congestion is often beneficial. It is commonly believed that recurrent epistaxis is indicative of rheumatism. In my experience this belief is rarely substantiated. It may however occur in hæmophilia, or in other forms of the hæmorrhagic diathesis.

As long as the bleeding lasts it is better not to interfere with the free exit of blood from the nostrils by plugging or other expedients. The old familiar nostrum of applying iced water, or a cold key, to the back of the neck, or of making the child hold his hands above his head and sit at an open window, are all so much moonshine, and entirely useless.

The child should be made as comfortable as possible in a semi-reclining position in an arm-chair, and reassured that nothing is to be feared, and that the bleeding will do more good than harm. He should however be encouraged to breathe through his mouth so as not to interfere by the to-and-fro passage of air with the formation of clots in the nostrils, which act as natural hæmostatics. A small quantity of dry cotton-wool inserted loosely into the nostril will also serve as a convenient starting-point for the coagulation of the blood.

The hæmorrhage may be treated locally if thought necessary by spraying the interior of the nose with a solution of adrenalin (1 in 1000), or thromboplastin. If none of these expedients stops the bleeding it may be necessary to loosely plug one or both nostrils with strips of gauze soaked in adrenalin solution or thromboplastin. The coagulability of the blood may be increased by the hypodermic injection of 2 c.c. of hæmoplastin (hæmostatic serum), or 4 c.c. may be given by the mouth in combination with 10 gr. of calcium chloride.

Hæmoptysis.

This may be treated by placing the child comfortably in the recumbent position and giving him a hypodermic injection of 1/30th of a grain of morphia and 2 c.c. hæmoplastin. In addition half a drachm of sulphate of magnesium in water may be given by the mouth.

Hæmatemesis.

With bleeding into the stomach and the vomiting of blood, all food should be temporarily suspended, although a few teaspoonfuls

of iced water may be swallowed: 2 c.c. of hæmoplastin and 1/30th of a grain of morphia may be injected hypodermically.

Hæmorrhages from the Bowel.

If the bleeding occurs high up in the bowel, the symptoms take the form of ordinary melæna, in which a black tarry substance is passed per anum. It is a common event in new-born infants, and constitutes one of the ways in which the so-called hæmorrhagic diathesis expresses itself. It is most satisfactorily treated by the intra-muscular injection of blood.

If the blood comes from the rectum, or lower part of the bowel, it is bright red in colour, and generally causes considerable alarm to mothers and nurses. It may come from a congested or varicose vein in the bowel wall, or from an ulcer or erosion. Occasionally it originates from a fissure or fissures situated in the sphincter ani itself, in which case there is generally a good deal of pain and spasm with the passage of small quantities of blood every time the bowels act. The treatment in these cases is not very easy. Constipation must be avoided, and so must all looseness of the bowels and frequency of action. The bowels are best regulated by a combination of bismuth and petroleum emulsion in some such form as the following:

Glycerine of Carbonate of Bismuth (B.P.C.)	½ drachm (1·75 c.c.)
Semprolin Emulsion	½ drachm (1·75 c.c.)

In addition to giving this mixture with each feed, it is advisable to insert gently into the anus a small quantity of bismuth in the form of an ointment or cream, immediately after each action. This acts as a useful lubricant, and it also has a soothing and healing effect on the bleeding surface.

Dental Hæmorrhages.

Excessive bleeding occasionally occurs after the extraction of a tooth, even in children under 5 years of age, but only as a rule in cases in which there is some hæmorrhagic tendency. It is best controlled by plugging the socket with gauze, which has been soaked in hæmoplastin or adrenalin solution (1 in 1000).

Cuts and Wounds

In the treatment of these accidents the important principles to remember are:

Firstly: That all hæmorrhage must be arrested.
Secondly: That any dirt or infective material must be removed.
Thirdly: That incised or damaged surfaces must be brought into close and correct apposition.

Fourthly: That the parts must be kept dry and free from discharge.

Fifthly: That the wound must be kept at rest so that union between the surfaces may occur.

Sixthly: That pain must be relieved.

To Arrest Hæmorrhage.

Apart from ligaturing all vessels which are sufficiently large to require this treatment, and the application of pressure on the proximal side of the arteries and on the distal side of the veins when smaller vessels are involved, it is usually unnecessary to take any particular steps to stop bleeding, but resort may be made in special circumstances to general or local hæmostatics. As regards the latter, calcium chloride tends to increase the coagulability of the blood, and thus to arrest hæmorrhage, but it is slow in action. The hypodermic injection of 1 c.c. of hæmoplastin, repeated if necessary at four-hourly intervals, meets with a more rapid response. Or 2 c.c. of the same preparation may be given by the mouth.

Locally the bleeding surface may be treated with thromboplastin, which may be sprayed over the damaged surfaces, or applied on sterile gauze.

Cleansing the Wound.

It is very important to remove all dirt or foreign material which has found its way into the wound at the time of the accident, and for this purpose the damaged tissues should be thoroughly irrigated with a mild antiseptic lotion which will not inflict any further injury on the affected tissues. A lotion consisting of monsol (1 in 400) is to my mind suitable for this purpose, but other antiseptic lotions such as carbolic acid (1 in 80), perchloride of mercury (1 in 5000), a saturated solution of boric acid, a 2 vols. per cent solution of peroxide of hydrogen, or weak solution of permanganate of potash (pale pink in colour), are in their way quite suitable, but the choice depends on the antiseptic available at the moment. It must however be remembered that whatever lotion is employed it must be used freely, for the more fluid used for the washout of the wound the better the result.

It is naturally impossible to determine with accuracy the character of the infective material which may have gained access to the wound at the time of the accident, but the most likely varieties are the germs of ordinary sepsis, tetany, or gas-gangrene. Unless the infective material is washed out of the wound immediately after the accident, it is extremely unlikely that by any method of irrigation it can be entirely removed from the zone of danger at

a later date. The popular belief that painting with tincture of iodine is a reliable prophylactic is in my opinion somewhat ill-founded. In some ways iodine is a valuable means of preventing infection because it is a dehydrating agent, and keeps the tissues commendably dry, but in other respects iodine is a poor antiseptic. Moreover, it often causes a good deal of pain when applied to raw surfaces.

From the point of view of prophylaxis cases of cuts or wounds, inoculation against sepsis, tetanus, or gas-gangrene may be extremely useful, but the practitioner will hesitate before taking so drastic a precaution unless he has solid grounds for believing that dangerous infective material has actually gained entrance to the wound.

With gunshot or other wounds of a ragged character, in which clothing or other unclean material may have contaminated the wound, and in all cases in which infection with the bacillus Perfringens (bacillus Welchii) is known to be, or suspected to be present, it is quite justifiable to give a prophylactic inoculation of the gas-gangrene anti-toxin, and the dosage should be in the neighbourhood of 4,000 units. Similarly, in cases in which the wound has been infected with horse-contaminated dust, or soil, a protective inoculation with anti-tetanus serum is indicated.

When children fall on gravel paths and cut or graze their knees, the problem always arises, should the prophylactic dose of anti-tetanus serum be injected ? Some of these cases seem so trivial that such a course seems hardly justified, but I remember one case in which a small boy tumbled down and grazed his knee with gravel, which was not suspected of being contaminated with the tetanus bacillus, but the symptoms of this infection developed shortly afterwards, and it was only with great difficulty that his life was saved. In any case of doubt I should therefore recommend the inoculation to be given, especially as it does not entail any serious trouble, expense, or consequence.

For the purpose of prophylactic inoculation, 1,000 units of St. Mary's Tested Tetanus Anti-toxin should be injected immediately after the injury has been inflicted, or as soon after as possible, and repeated once or twice at seven-day intervals.

As regards the prophylactic use of anti-streptococcic serum, the practitioner should be guided by the extent to which the wound has been exposed to possible sources of infection, and indeed to the area of skin involved. It is especially in cases of scalp wounds that septic infection may be anticipated. A prophylactic dose is 5 c.c. of the refined and concentrated streptococcic anti-toxin (erysipelas). It may be repeated once after an

interval of 24 hours. In any of the above cases when serum inoculations are contemplated, it is just as well to inquire whether any previous serum injections of any kind have been given, and if they have, to desensitize by the usual method of initial minimal doses (page 720).

Stitching and Suturing of Cut Surfaces.

Whether stitches are required to bring the cut surfaces into apposition, is another problem which has frequently to be solved in incised or contused wounds. If the edges can be brought together and kept there by strapping, bandages, or other means, and if there is any likelihood of healing by first intention, stitches or sutures should be avoided, but otherwise, even at the cost of inflicting a certain amount of pain, the wound should be securely sutured. The question of scarring should always be remembered, especially when the wound is on the face. Healing by first intention should always be aimed at, and the markings of the skin by the sutures should be avoided by interposing small pieces of protective tissue between the skin and the sutures themselves.

Keeping the Wound Dry.

One of the most important essentials in securing the healing by first intention, and in thus preventing subsequent suppuration or scarring, is to provide for the immediate blotting up of all exudations from the damaged surface by suitable absorbent dressings, and by firm bandaging, not so tight however as to cause strangulation of the parts but otherwise as tight as can be conveniently borne. It is a good plan to dust the surface of the wound with an absorbent and drying dusting powder. Of all powders of this kind I believe that iodoform is the best, but it has such a disagreeable odour that it is generally avoided. A good powder, and free from odour, is the bismuth formic iodide compound (B.F.I.) (Mulford). Although ointments and other greasy preparations prevent the gauze or other dressings from adhering to the edges of the wound, and thus causing pain on removal and the reopening of the wound, they are not in my opinion so satisfactory as dry dressings, because they prevent the discharges from coming into contact with the dressings, and thereby being absorbed—in fact they keep the wound itself in a moist rather than in a dry condition.

Keeping the Wound at Rest.

Any movement or friction between the edges of the wound prevents cohesion and union. For this reason the damaged parts should be kept at rest, and immobilized by careful bandaging, and if possible, by splinting. It is just as necessary to keep the surfaces of the ruptured tissues at rest and in close apposition

until they become united, as it is to keep the ends of a fractured bone completely immobilized.

Relief of Pain.

Healing is certainly promoted by the relief of pain, because it allows of sleep, which is a reliable guarantee against movement. In my opinion in cases of wounds which are sufficiently painful to interfere with sleep, the administration of a soporific or anodyne is justifiable. I have found for this purpose full doses of bromide, 10–20 gr., useful and reliable. I can also recommend the administration of sommnosal (Napp) to the extent of 3 grains as being quite useful and harmless. As a local anodyne chloretone or benzocaine (page 704) may be applied to the wound.

Burns and Scalds

The following directions for the treatment of burns and scalds include also the treatment of analogous injuries inflicted by lightning, electricity, strong acids, alkalies, and other escharotics.

For something like 48 hours after the infliction of a burn a period of shock follows, with slow pulse and circulatory depression, which is more or less proportional in its severity to the area of skin involved. As the result of a burn the blood rapidly becomes concentrated, with the consequence that the red blood cell count is correspondingly raised. It is not known definitely to what this shock is due, but it has been suggested with some degree of probability that it is caused by some toxic body, perhaps of the nature of Histamine, which is liberated by the damage inflicted upon the tissues.

Treatment. *Prophylactic.* It is perhaps unnecessary to describe here the various "Safety-First" precautions which may be taken in the nursery, the kitchen, and in the living-room to prevent accidents of this kind, but it may be pointed out that most of them occur owing to the fact that open fires are not adequately protected by guards, and because teacloths offer a tempting invitation to the young child to pull, and thus upset teapots, jugs, cups, and other vessels containing hot liquid which may happen to be on the table. Other dangers are hot-water bottles, loose electric flexes, unsafe paraffin lamps, and inflammable toys or dress materials.

Curative. The first necessity is to treat the shock, and this should be done before applying any local remedies to the burn itself, which may well wait. For this purpose the child should be kept as quiet as possible, and under warm conditions, provided with hot-water bottles, electric blankets, or in severe cases by immersion in warm baths at a temperature of about 103° F. and

if thought necessary, containing boracic acid, or bicarbonate of soda, each to the extent of about 1 tablespoonful to the gallon of water. Hot drinks, consisting of brandy and water, coffee, or other stimulant, should be given, and pain should be relieved by some anodyne, such as opium. The hypodermic injection of morphia is probably the best and most rapid way of effecting the latter object for an infant 1 year old; 1/60th of a grain is not too large a dose for this purpose, or 1 drop of nepenthe, or tincture of opium. The dose may be repeated up to the limits of tolerance.

To counteract the dehydration of the tissues which almost invariably takes place in cases of severe burning, fluid should be introduced into the system by the rectal, subcutaneous, or intravenous route, if sufficient amounts cannot be taken by the mouth. During the early stages of shock it is worse than useless to attempt to keep up the child's strength by forcing him to take food against his will. But diffusible stimulants, such as coffee, tea, brandy, or beef-tea, with plenty of water, are valuable mediums for compensating for the dehydration, and may possibly assist in the elimination of the toxic substances liberated in the injured tissues.

Local Treatment. The old methods of treatment by carron oil (equal parts of linseed oil and lime water) saturated solutions of picric acid, solutions of bicarbonate of soda, olive oil, or paraffin, have been almost entirely superseded by the tannic acid treatment, which introduces entirely new therapeutic principles, and marks an enormous advance in the technique for dealing with these troublesome cases. In view of the great superiority of the tannic acid treatment, it is important that nothing should be done immediately after a burn has been inflicted to interfere with the ultimate benefits due to the application of tannic acid, as for instance, by applying carron oil, olive oil, or other greasy preparations to the damaged areas. It is even better if possible not to apply wet dressings of any kind, since they may interfere with the full benefits of the tannic acid applications.

The burnt area should be cleaned up with methylated ether, and subsequently with methylated alcohol. Loose pieces of charred tissue or the skin of blisters should be removed as gently as possible with forceps. After this a freshly prepared 5 per cent aqueous solution of tannic acid should be sprayed over the entire surface, or applied by means of light dressings thoroughly soaked with the same solution. My own experiences suggest that the substitution of a 1 in 8 preparation of tannic acid in alcohol for the weaker aqueous solution, gives more immediate and more permanent results.

The advantages of the tannic acid treatment have been well summarized by Bancroft [1] as follows:

(1) It diminishes pain.
(2) It prevents fluid depletion.
(3) It checks toxæmia.

Subsequently the tannic acid solution should be applied sufficiently often to produce a protective membrane, which is tough and brown-coloured. It may be necessary to spray once every day for the first few days, or to change the dressings daily. Delay in the use of tannic acid may be avoided by keeping Tannafax (tannic acid jelly) as an emergency substitute.[2]

Complications.

Sepsis. This is a frequent complication, and is often the cause of death. It is difficult to prevent when a large surface is involved, but care must be taken to see that pus or other septic discharges are not pent up under the protective membrane formed by the tannic acid. If there is any indication of this, the membrane must be incised, and the discharge evacuated. Subsequently, dressings of acriflavine (1 in 1500) must be applied to the unhealthy surfaces.

Broncho-pneumonia. This is a very common complication and may occur at any stage. It is probably due to the absorption of toxins. It must be treated on the general lines laid down in the section on this subject (page 268).

Gastro-enteritis. This is another serious complication which is more liable to occur in young subjects. It must be treated on the general lines suitable for the condition (see page 190).

Duodenal Ulcers. This is also a recognized complication. It is serious because perforation may occur, and if not anticipated, may possibly be overlooked. The prophylactic treatment is continuous administration of bicarbonate of soda, and milk of magnesium. Should perforation occur there is no other recourse except immediate operation.

Sprains

A sprain generally means the partial rupture of a ligament or ligaments supporting a joint, and it is generally due to some violent wrench. It is accompanied or followed by hæmorrhage or effusion of lymph, and the pain is largely due to swelling and

[1] BANCROFT. *New English Journal of Medicine*, 1930, April 24, p. 811.

[2] It is supplied by Burroughs Wellcome & Co., in tubes of two sizes, and is of great value as a first-aid application, until a freshly prepared solution of tannic acid can be obtained.

tension in the parts affected. The ankle and wrist are the most common sites of such injuries.

Treatment. If the damaged joint can be skilfully massaged immediately after the injury is inflicted, and then firmly bound with a non-elastic bandage, little or no effusion will take place. By saturating the bandage with an evaporating lotion, or ice water, the inflammatory reaction is checked, and recovery expedited.

Although modern practice favours an early resumption of the use of the affected joint, it seems to me to be only common sense to treat this special form of injury just as any other variety of trauma, by rest, in order to provide the necessary conditions for recovery, and union of the ruptured fibres.

With a sprained ankle the leg itself should be elevated and kept on a pillow. A sprained wrist should be splinted and kept in a sling.

Fractures

This is not the place to discuss in detail the treatment of fractured bones. Whenever a fracture is suspected, or is known to have occurred, the limb should be kept in as comfortable a position as possible, and at complete rest, until the diagnosis can be confirmed by X-rays. A surgeon should then be consulted.

Obstetric fractures in new-born babies have already been dealt with on page 151, and to this the reader is referred.

Dislocations

Dislocations of joints, like fractures of bone, are matters for the surgeon, and their treatment should not be lightly undertaken by the general practitioner. Actions for mal-praxis or want of skill are not altogether unknown in this connexion, and should be provided against by sharing the responsibility with some surgical authority.

Stings and Bites

In general it may be stated that if Dettol (undiluted) is rubbed well into the skin at the exact spot bitten or stung by an insect, it has a most salutary effect in preventing subsequent swelling and irritation. But certain stings or bites require more specialized treatment.

Bee Stings. The stings of these insects are best treated by rubbing ammonia into the skin. Ordinary Scrubb's ammonia diluted 1 in 8, answers perfectly well. If this is not available, milk of magnesia, or a solution of bicarbonate of soda (a teaspoonful to 2 oz. of water) answers nearly as satisfactorily.

Wasp Stings. Stings of these insects should be treated by vigorously rubbing in vinegar, diluted with an equal part of water.

Gnat, Midge, and Mosquito Bites. The stings of these insects are best treated by vigorous rubbing with Dettol, which should be undiluted.

Snake Bites. If an arm or leg is the site of the bite, a tourniquet should be applied between the bite and the heart, thus preventing the poison entering the lymphatic system, and finally reaching the general circulation, but such a tourniquet must be applied immediately after the infliction of the bite, and the same rule applies to the local treatment. If not applied at once, it is practically useless. The details of treatment are as follows. The area of the bite should be scarified with a scalpel or knife, and permanganate of potash powder should be well rubbed into the tissues. To counteract the shock and depression which usually ensue some hours after a bite, it is advisable to give stimulants such as hot coffee, beef-tea, or brandy and water, and 1–2 units of pitressin (P. D. & Co.), or 5 minims of a 1 in 1000 solution of adrenalin may be injected hypodermically.

Foreign Bodies in the Eye

Foreign bodies in the eye are generally embedded in the conjunctival sac, or in the substance of the cornea. Hard bodies with sharp edges, such as splinters of glass or metal, may puncture the cornea or sclerotic, and enter the anterior or posterior chambers of the eye. Occasionally they may become embedded in the retina.

Foreign Bodies in the Conjunctival Sac.

Foreign bodies generally lodge in the mucous membrane which lines the upper eyelid. They may be firmly embedded, or loosely attached. In any case the lid should be everted, and the object removed by a curette or other suitable implement. If necessary a drop of 4 per cent solution of cocaine should be instilled into the eye. After the removal of the object, a few drops of liquid petroleum should be inserted into the eye which should be kept bandaged until the effects of the cocaine have passed off.

Foreign Bodies in the Cornea.

Foreign bodies sometimes become firmly embedded in the substance of the cornea, in which case it is necessary to dig them out after cocainization, with a needle or other suitable instrument. After removal the eye should be thoroughly cleansed with boracic

lotion and a few drops of liquid paraffin instilled into the eye, and the latter securely bandaged until the effects of the cocaine have passed off.

Should there be any evidence of inflammation, atropine should be inserted into the eye in the form of oleum atropinæ or guttæ atropinæ 2 per cent.

Foreign Bodies in the Interior of the Eyes.

Foreign bodies in the aqueous or vitreous humours should be dealt with by an expert ophthalmologist, as the results may be serious, and the question of removal of the eyeball has to be considered.

Foreign Bodies in the Nose

Children often insert such things as buttons, beads, pieces of chalk or lead pencil, into their noses without attracting attention, and these foreign bodies may remain *in situ* long enough to set up inflammation and purulent discharges, and possibly sinusitis. So-called rhinoliths which consist of calcareous incrustations round central cores of bloodclots are sometimes lodged in one or other of the nostrils. They act as foreign bodies, and may give rise to intermittent epistaxis. Under good illumination such foreign bodies can usually be located and removed with suitable grasping or polypus forceps. An anæsthetic however may be required if the object is not removed at the first attempt.

Foreign Bodies in the Ear

Such bodies generally consist of wax, peas, beans, beads, buttons, or pebbles, which have been deliberately introduced into the meatus by the child. It may be possible to remove these, if they are not tightly impacted, by syringing. For this purpose the stream of water must be directed along the posterior wall of the meatus, so that it can pass along the side of the obstruction and swill the object out on its return. Foreign bodies which cannot be dislodged by such means must be removed under good illumination by means of forceps or special hooks. Hard balls of wax which are often impacted at the bottom of the meatus, should be softened for two or three nights beforehand with a solution of the following formula :

Bicarbonate of Soda	10 gr.
Glycerine	2 drachms
Water to make	1 oz.

The meatus should be plugged with a pledget of cotton-wool soaked in paraffin. The ear is then syringed in the manner above described.

Foreign Bodies in the Alimentary Tract

Young children often swallow such objects as buttons, coins, stones, bits of wood, pins, nails, and screws, either intentionally or by accident, but they are still more often incorrectly credited with having done so.

In all suspected cases, the diagnosis should be confirmed by X-rays, but it must be remembered that celluloid objects, as for instance buttons, do not reveal themselves by this means, and therefore may escape detection.

It is remarkable what large objects can be swallowed with immunity, and subsequently passed per anum without much pain or discomfort. Whenever the existence of a large foreign body in the interior of the alimentary canal has been confirmed by X-ray examination, its progress down the tract should be followed by periodic re-examinations. If the object is found to be moving progressively in the right direction, it may be left alone.

I remember one case of a child who swallowed a coin which was located in the stomach next day by X-ray examination. The child was subsequently X-rayed daily for a whole week, but the coin remained in the same situation. It was therefore decided to remove it by opening the stomach. At operation no coin was discovered in the position expected, but 2 days later the child passed it when he went to stool. The moral of this surgical solecism is that the presence of a foreign body should be verified immediately before operation by means of X-rays.

It is at times a little difficult to prophesy whether or no foreign bodies will be passed in due course in the natural way. They sometimes become lodged in a *cul de sac*, such as the appendix, or a Meckel's Diverticulum, and in such cases they can only be removed by surgical operation.

I was once consulted in reference to a baby who was supposed to have swallowed some quicksilver, owing to the breaking of a milk thermometer which had been used to test the temperature of its feed. Incidentally, he was also believed to have swallowed some of the glass of which the bulb of the thermometer was composed, and which was missing after the accident. The child was X-rayed at once, and the mercury was discovered to be held up in the appendix. The child was inverted daily for a few minutes, and by degrees the whole of the quicksilver was recovered in its stools, and this, together with the broken thermometer is one of the treasured possessions in the " Curiosity " collection at The Infants Hospital.

Treatment. Although children who have swallowed foreign

bodies are generally stuffed with suet puddings and other starchy varieties of food in the hope that the object may thereby be helped to negotiate the pylorus, I do not think that if it cannot be passed successfully under ordinary conditions of feeding, that it is in the least likely to do so with the aid of such indigestible articles of diet.

The treatment in all these cases can be summed up in a few words—a masterly inactivity, combined with periodic X-ray examinations.

Foreign Bodies in the Larynx. Choking

Mild degrees of choking are caused by spasm of the muscles of the glottis due to the lodgment of a crumb or other irritating article of food in the rima glottidis or neighbouring parts. The spasm may however be set up by foreign bodies finding their way into the naso-pharynx, just above the soft palate, but neither of these accidents is of serious import, and the source of irritation is generally removed by the vigorous coughing which accompanies the spasm. The symptoms are in fact due to functional obstruction of the larynx. But the variety of choking which is of serious nature is that which is due to occlusion of the larynx or other part of the upper respiratory tract by the impaction of some sufficiently large foreign body, such for instance as a large piece of meat. Such an obstruction may occur just above the vocal cords, between the vocal cords, or in the ventricle of the larynx. In such events, first-aid treatment must be applied if life is to be saved. In all cases of serious choking, and in the presence of symptoms suggesting impaction of a foreign body, the child should be held up by his feet and vigorously thumped with the flat of the hand between the shoulders. If this fails to remove the obstruction, and the child shows evidence of asphyxiation, two fingers should be passed well to the back of the mouth and an attempt made to hook them round any foreign body which is within reach. It must be admitted however that the removal of the obstruction by this means is seldom possible.

If all these methods fail, the final resort must be laryngoscopy, and if necessary a laryngotomy may have to be performed as an emergency operation. For further details see page 251.

Poisons and their Antidotes

Acetanilide : (Anti-febrin and Phenylacetamide.)

Emetics, inhalations of ether, oxygen ; stimulants such as strychnine hypodermically, and warmth to body and feet.

Ammonia :

Vinegar, lemon, or orange juice, well diluted with water. Tracheotomy may be necessary, and morphine will relieve pain.

Antifebrin : (See Acetanilide.)

Antimony : (Including Antimonial Wine, and Tartar emetic.)

Strong tea or solution of tannin, repeated as often as vomiting occurs. When the latter ceases, give white of egg in milk, or water. Stimulants may be required to counteract depression, and morphine to quieten the nervous system.

Antipyrin :

Brandy, ether, strychnine, oxygen.

Arsenic :

Wash out the stomach with warm water, and give hydroxide of iron (Liquor Ferri Dialysatus) with oxide of magnesium (or Milk of Magnesia). This mixture is technically known as "Antidotum Arsenici."

Aspirin : ("Aspro," Acetyl-salicylic Acid.)

Wash out the stomach, or give emetic followed by stimulants, such as strychnine, caffeine, ammonia.

Atropine : (See Belladonna.)

Belladonna :

Give emetics and stimulants with pilocarpine, with or without morphine.

Benzol :

Give emetics and carry on artificial respiration. Douche chest alternately with hot and cold water. Stimulants are generally necessary.

Bromine : (See Chlorine.)

Butylchloral Hydrate :

Emetics, caffeine, coffee, and atropine.

Caffeine :

Give emetics or wash out stomach. Give nitro-glycerine, apomorphine, or hypodermic injection of morphine with atropine.

Camphor : (Camphorated oil.)

Emetics, stimulants, hypodermic injection of caffeine.

Cantharides :

Wash out stomach or give emetics, as immediate treatment. If delayed give white of egg in barley water, or thick gruel. Morphine if much pain.

Carbolic Acid :

Give saccharated lime water, sulphate of soda, white of egg, and stimulants. Saline transfusions may help if there is collapse. Iodine is a true antidote and may be given in the form of the Tincture, in the same quantity as that of the amount of carbolic acid taken, but well diluted with water.

Carbon-Monoxide : (Petrol, or Coal Gas fumes.)

Artificial respiration, oxygen, and stimulants. Bleed, and transfuse grouped blood.

Caustic Potash :

Dilute vinegar, lemon, or orange juice. Liquid petroleum. Do not pass stomach tube or give emetics.

Caustic Soda : (See Caustic Potash.)

Chloral :

Keep patient awake. Strong ammonia to nostrils. Wash out stomach or give emetics. Artificial respiration may be necessary. Hypodermic injections of strychnine.

Chlorine :

Inhalations of alcohol. For cardiac depression inject camphorated oil—for subsequent respiratory distress treat as acute bronchitis.

Chlorodyne : (See Morphine.)

Chloroform : (Either inhaled or swallowed.)

Amyl-nitrite inhaled, or given hypodermically. Artificial respiration. Hypodermic injection of pituitrin.

Coal Gas : (See Carbon-Monoxide.)

Cocaine :

Wash out stomach. Amyl-nitrite, ether, and strychnine hypodermically. Artificial respiration if necessary.

Codeine : (See Morphine.)

Corrosive Sublimate : (See Mercury.)

Creosote : (See Carbolic Acid.)

Cyanide : (See Hydrocyanic Acid.)

Digitalis :

Emetics, hypodermic injection of aconitine nitrate, or atropine : recumbent position.

Dover's Powder : (See Morphine.)

Exalgin : (See Acetanilide.)

Foxglove : (See Digitalis.)

Fungi : (Toadstools, Mushroom poisoning.)

Wash out the stomach or give an emetic. Weak permanganate of potash, brandy.

Hydrargyrum : (See Mercury.)

Hydrocyanic Acid :

Give stimulants and inhalations of ammonia. Wash out the stomach or give emetic if there is time, and give large doses of ferrous sulphate solution.

Hyoscine : (Scopolamine, Twilight Sleep.)

Hypodermic injection of pilocarpine.

Iodine :

Wash out stomach or give emetics, mucilage or starch. Saccharated lime water, and morphine relieve pain.

Jaborandi :

Hypodermic injection of Atropine.

Laudanum : (See Morphine.)

Lead :

Give emetic, or wash out stomach. Dilute sulphuric acid in water. Morphine to relieve pain.

Lunar Caustic : (Silver Nitrate.)

Table salt in water, white of egg or milk.

Lysol : (See Carbolic Acid.)

Morphine :

Keep patient awake. Wash out stomach with weak permanganate of potash : if morphine taken by the mouth. Stimulants of all kinds, ammonia, strychnine, caffeine, coffee, etc.

Mushroom Poisoning : (See Fungi.)

Mustard Gas : (See Chlorine.)

Nepenthe : (See Morphine.)

Nicotine :

If swallowed, wash out stomach. If inhaled, give morphine, and stimulants.

Nightshade : (Deadly Nightshade) (see Atropine.)

Opium : (See Morphine.)

Oxalic Acid :

Precipitated chalk. Saccharated lime water. Do not give soda or other alkalies.

Petrol :

Fresh air, oxygen inhalations. Injection of camphor.

Phenacetin : (See Acetanilide.)

Phenazonum : (See Antipyrin.)

Phosphorus :

Weak permanganate of potash. 1 gr. of sulphate of copper every 5 minutes until vomiting is induced : to be continued in smaller doses for 15 minutes, with small doses of morphine.

Plumbum : (See Lead.)

Potassium Cyanide : (See Hydrocyanic Acid.)

Ptomaines :

Finely powdered charcoal and stimulants, antipyrin.

Rat Paste : (See Phosphorus or Arsenic.)

Red Precipitate : (See Mercury.)

Salts of Sorrell or Lemon : (See Oxalic Acid.)

Scopolamine : (See Hyoscine and Morphine.)

Silver Nitrate : (See Lunar Caustic.)

Strophanthus :

Give emetic, tannin, and stimulants.

Strychnine :

Emetics, permanganate of potash, chloral, bromide, and morphine.

Sulphonal :

Emetics, strong coffee, strychnine, artificial respiration.

Trional : (See Sulphonal.)

Vermin Killer : (See Strychnine or Arsenic.)

Veronal : (See Sulphonal.)

Weed Killer : (See Arsenic.)

White Precipitate : (See Mercury.)

APPENDIX

PART I

PRESCRIPTIONS AND PHARMACOPŒIAL PREPARATIONS MENTIONED IN THE TEXT, OR OTHERWISE RECOMMENDED

Dosage

The dosage in the prescriptions given in the text of this book and in the following list is, unless otherwise stated, intended for an infant 1 year old, while dosage for older and younger children can be calculated on a basis of weight.

The average weight of an infant 1 year old is about 21 lb. (9·5 kilo) : the average weight of an infant 3 months old is 10½ lb. (4 kilo 750 gm.) or about half that of a child 1 year old : while the weight of a child 4 years of age is about 40 lb. (18 kilo 120 gm.), or about double that of a child 1 year old. Hence for children of these ages—*i.e.* 3 months and 4 years, the doses to be given should be respectively, half and double those prescribed for a child of 1 year, with corresponding adjustments for children of intermediate ages or weights.

I regard this rule for calculating the proportional doses required by children of different ages as more practical than the usual one, which is to multiply the adult dose by a factor which is arrived at by dividing the age of the child by the same age, plus 12. For instance, to calculate the proportional dose for a child 4 years of age by this method the adult dose must be multiplied by this factor, *i.e.*

$$\frac{4}{4+12} = \frac{4}{16} = \frac{1}{4},$$

in other words, the proportional dose is one-quarter that of an adult.

I may say with regard to dosage that in my opinion most drugs are given to infants in far too small quantities. Personally I am not a great believer in drug treatment of any kind for young

children, but if drugs are given at all they should be given up to their full therapeutic value. For instance, to give an infant 1 year old 1 gr. of bromide to induce sleep, or 2 gr. of bicarbonate of soda to correct acidosis, or 3 gr. of bismuth to allay the tormina of intestinal colic, is entirely inadequate. This being my view, the reader need not be surprised at the magnitude of some of the doses recommended.

There are certain drugs to which infants and children show great tolerance, while to others they are peculiarly sensitive. For instance, they can stand very large doses of belladonna, hyoscyamus, chloral, alkalies of all sorts, and cathartics, but opium must be given with extreme caution, not only because all children are very susceptible to its influence, but because some have a definite hypersensitiveness to its action.

The following series of prescriptions includes most of the formulæ which have already been referred to in the text, but it also contains certain others to which I attach special value.

EQUIVALENTS OF IMPERIAL AND METRIC DOSAGE

(in round figures)

To convert *grains* into *grammes* multiply by 0·0648 *or* divide by 15·432.

To convert *grammes* into *grains* multiply by 15·432 *or* divide by 0·0648.

1 fluid drachm = approx. 3·5 c.c.

For convenience when expressing doses it is usual to consider 15 minims as equivalent to 1 c.c., although a more exact approximation is 17 minims.

250	grains	or	minims	=	17,500	mg.	=	17·5	gm.	or	c.c.
100	,,	,,	,,	=	7,000	,,	=	7	,,	,,	,,
20	,,	,,	,,	=	1,200	,,	=	1·2	,,	,,	,,
15	,,	,,	,,	=	900	,,	=	0·9	,,	,,	,,
10	,,	,,	,,	=	600	,,	=	0·6	,,	,,	,,
9	,,	,,	,,	=	546	,,	=	0·54	,,	,,	,,
8	,,	,,	,,	=	482	,,	=	0·48	,,	,,	,,
7	,,	,,	,,	=	428	,,	=	0·42	,,	,,	,,
6	,,	,,	,,	=	364	,,	=	0·36	,,	,,	,,
5	,,	,,	,,	=	300	,,	=	0·3	,,	,,	,,
4	,,	,,	,,	=	250	,,	=	0·25	,,	,,	,,
3	,,	,,	,,	=	200	,,	=	0·2	,,	,,	,,
2	,,	,,	,,	=	130	,,	=	0·13	,,	,,	,,
1	,,	,,	,,	=	64	,,	=	0·06	,,	,,	,,
½	,,	,,	,,	=	32	,,	=	0·032	,,	,,	,,
¼	,,	,,	,,	=	16	,,	=	0·016	,,	,,	,,
1/10th	,,	,,	,,	=	6	,,	=	0·006	,,	,,	,,
1/20th	,,	,,	,,	=	3	,,	=	0·003	,,	,,	,,
1/100th	,,	,,	,,	=	0·6	,,	=	0·0006	,,	,,	,,

TONICS

The following syrup containing mixed hypophosphites with small quantities of glycerine, strychnine, and iron, constitutes an excellent tonic, especially for children over 1 year of age.

Compound Syrup of Hypophosphites (B.P.C.) 15–30 minims (0·9 c.c.–1·8 c.c.)
Water to make 1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) three times daily.

Anæmia

In the treatment of anæmia it is naturally important to distinguish between the primary and secondary forms, or to speak more accurately, between anæmias due to diminished blood formation, and anæmias due to increased blood disintegration.

Primary Anæmia.

For this form, liver preparations and arsenic are indicated (page 707). In the treatment of children it is most desirable to supply the liver substance, which in its natural state is somewhat nauseating, in a sufficiently agreeable form to enable the child to take the necessary quantity. It may be given orally in the almost tasteless form of Hepatex (Evans). The dose is from 20 to 40 drops (1·25 c.c. to 2·5 c.c.) three times a day, or it may be given by intra-muscular injection. For this purpose Neo-hepatex (Evans) may be given to the extent of 5–10 minims (0·3 to 0·6 c.c.) daily in three doses, and after that at weekly intervals, with slightly increasing dosage. This preparation for hypodermic injection is supplied in ampoules. (See also page 707.)

Secondary Anæmia.

For this, Minadex (Glaxo laboratories) is a very serviceable preparation. It contains iron, manganese, and copper, as well as glycerophosphates, and vitamins A and D. It should be given to the extent of ½ drachm (1·75 c.c.) daily. (See also Greenosan, page 707.) If a simple iron mixture is preferred, it should be given in large doses, and consist of the citrate.

Citrate of Iron . . . . . 6 gr. (0·36 gm.)
Simple Syrup . . . . . 10 minims (0·6 c.c.)
Water to make 1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) three times daily.

Ferrous Sulphate Tablets (G.L.) are also useful.

Dosage : 3 tablets daily.

Stimulants for Emergencies

Coramine. (Ciba.)

This is a 25 per cent pleasantly flavoured solution of pyridine-β-carboxylic-acid-diethylamide. It is a useful cardiac and res-

piratory stimulant in cases of heart failure in pneumonia, influenza, and sepsis, and for emergencies in general.

Dosage : For oral administration :
5–10 minims (0·3 to 0·6 c.c.) in water.
Hypodermically :
(Ampoules) 5–10 minims (0·3 to 0·6 c.c.)

THE RESPIRATORY SYSTEM

Cough Mixtures

The various stages of inflammation of the respiratory mucous membrane require their respective lines of treatment, according to the existing pathological condition. For these the following prescriptions are suitable in the order given :

Bronchitis *(See also page 260)*

1*st Stage.* *Mistura Tussis Infantilis.* *Mixture No.* 1.

Citrate of Potassium	3 gr.	(0·2 gm.)
Iodide of Ammonium	1 gr.	(0·065 gm.)
Ipecacuanha Wine	2 minims	(0·13 c.c.)
Camphorated Tincture of Opium	3 minims	(0·2 c.c.)
Syrup of Orange	10 minims	(0·6 c.c.)

Water to make 1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) three times daily.

2*nd Stage.* *Mistura Tussis Infantilis.* *Mixture No.* 2.

Carbonate of Ammonium	1 gr.	(0·065 gm.)
Tincture of Squills Ipecacuanha Wine	2 minims	(0·13 c.c.)
Syrup of Tolu	5 minims	(0·3 c.c.)

Water to make 1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) three times daily.

3*rd Stage.* *Mistura Tussis Infantilis.* *Mixture No.* 3.

Carbonate of Ammonium	1 gr.	(0·065 gm.)
Terebene	2 minims	(0·13 c.c.)
Syrup of Tolu	5 minims	(0·3 c.c.)
Gum of Acacia	½ gr.	(0·032 gm.)

Water to make 1 fluid drachm (3·5 c.c.)
To make an Emulsion.

Dosage : 1 fluid drachm (3·5 c.c.) three times daily.

Cough Syrups

To relieve the cough itself and to allay irritation, the following elixirs are advised : they have no curative effect on the catarrhal condition of the mucous membrane :

Elixir of Heroin.

Heroin	1/100th gr. (0·00065 gm.)
Syrup of Virginian Prunes	10 minims (0·6 c.c.)
Syrup of Tolu	10 minims (0·6 c.c.)
Glycerine	10 minims (0·6 c.c.)

Water to make 1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) occasionally.

Another very satisfactory cough elixir is :

Elixir of Pine, Terpine, and Heroin.

Linctus of Pine, Terpine and Heroin (Martindale) . 10 minims (0·6 c.c.)
Water to make 1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) occasionally.

Anti-Spasmodics

Anti-spasmodics are drugs which relieve violent or irregular muscular contractions. For the most part they are used in connection with respiratory or intestinal spasms. Respiratory anti-spasmodics are included among the asthma " cures " (see below) while the intestinal anti-spasmodics are given under the heading of " carminatives " (see page 692).

Asthma

For asthma, compound stramonium powder (B.P.C.), Himrod's, or Bliss's Cure, should be burnt in proximity to the child, so that he can inhale the fumes.

The following is a good old-fashioned oral remedy which sometimes answers when the newer preparations fail :

Iodide of Potassium	2 gr. (0·13 gm.)
Tincture of Belladonna	2 minims (0·13 c.c.)
Etherial Tincture of Lobelia	2 minims (0·13 c.c.)

Chloroform water to make 1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) as required.

Of the many ephedrin preparations now available for the treatment of asthma, I regard the B.P. preparation elixir of ephedrin hydrochloride as the most suitable for ordinary oral use. It may be prescribed as follows :

Elixir of Ephedrin Hydrochloride (B.P.) . 10 minims (0·6 c.c.)
Water to make 1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) as required.

Ephedrin may also be administered by inhalation, in which case it may be prescribed as follows :

Compound Ephedrin spray (B.P.C.) to be administered nasally by a nebulizer.

For emergencies a hypodermic injection of 2 to 3 minims (0·13 to 0·2 c.c.) of a solution of adrenalin hydrochloride (1 in 1000) is useful.

Whooping-Cough

Mistura Pertussis.

Potassium Nitrate	½ gr.	(0·032 gm.)
Ammonium Bromide	4 gr.	(0·25 gm.)
Ammonium Iodide	1 gr.	(0·065 gm.)
Ammonium Carbonate	½ gr.	(0·032 gm.)
Tincture of Belladonna	5 minims	(0·3 c.c.)
Wine of Ipecacuanha	5 minims	(0·3 c.c.)

Chloroform water to make 1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) three times a day or oftener.

Hay Fever

This may be treated by the local application to the nose of adrenalin and chloretone ointment (P. D. & Co.), or adrephine ointment (P. D. & Co.), or by a nasal spray consisting of compound inhalant of ephedrin (P. D. & Co.), or by hypodermic injections of 3 minims (0·2 c.c.) of adrenalin hydrochloride (1 in 1000).

Sedatives, Anodynes, and Narcotic Drugs

In my experience the mixed bromides in full doses are safe sedatives to give to infants, but the dose must be really large to be effective. I do not hesitate to give as much as 10 to 15 gr. (0·65 to 0·9 gm.) to a child 1 year old. Chloral and opium are also useful and may be given in combination with the bromides, but must be used with caution.

Mistura Dentatis.

Bromide of Sodium Bromide of Potassium Bromide of Ammonium	of each 2 gr.	(0·13 gm.)
Hydrate of Chloral	1 gr.	(0·065 gm.)
Camphorated Tincture of Opium	2 minims	(0·13 c.c.)
Simple Syrup	20 minims	(1·2 c.c.)

Water to make 1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) three times daily or more frequently.

Luminal and other barbituric preparations should be used with great caution in the case of children, and only for a short period. One of the best of these preparations is Cibalgin. It is a combination of amidopyrin with dial or allobarbitone. I have found it extremely useful in cases of so-called sick-headache or migraine, and also for neuralgia, toothache, painful dentition, and earache.

Dosage : The dose should be 3 drops (0·2 c.c.) of Cibalgin solution, or one/sixth of a tablet (0·6 gr. or 0·04 gm.).

Rheumatism

Anti-Rheumatic Mixtures.

The two drugs which are of the most service in the treatment of rheumatic conditions in young children are salicylic acid and acetylsalicylic acid (Aspirin).

With these two drugs available there is no need to resort to any of the newer preparations such as Novalgin (Bayer), Cinchophen, or the barbituric preparations, nor to any of the old-fashioned remedies such as salicin, quinine, or colchicum. The following is the prescription of the mixture that I most frequently employ :

Salicylate of Sodium . . . 2½ gr. (0·162 gm.)
Sodium Bicarbonate . . . . 5 gr. (0·324 gm.)
Syrup of Orange . . . . 10 minims (0·6 c.c.)
Peppermint water to make 1 fluid drachm (3·5 c.c.)
(If preferred Acetylsalicylic Acid (Aspirin) may be substituted for the Salicylate of Sodium.

Dosage : 1 fluid drachm (3·5 c.c.) three times a day.

THE ALIMENTARY SYSTEM

Digestive Mixtures

If the gastric digestion is at fault, and there is reason to believe that the child is suffering from a condition of hypochlorhydria, it is better to give an acid mixture which contains pepsin, or papaine, immediately before feeding. The following mixture serves this purpose :

Dilute Hydrochloric Acid . . . 10 minims (0·6 c.c.)
Elixir of Pepsin (B.P.C.) . . . 10 minims (0·6 c.c.)
Water to make 1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) before feeds.

If on the other hand either intestinal or pancreatic digestion is at fault, as indeed is often the case, it is better to give an alkaline mixture with some preparation of pancreatic ferments such as the following about 2 hours after a meal :

Glycerine of Pancreatin . . . 20 minims (1·2 c.c.)
Bicarbonate of Soda . . . . 7 gr. (0·42 gm.)
Peppermint water to make 1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) 2 hours after a feed.

For those forms of intestinal indigestion which are accompanied by flatulence, colic, or undigested motions, the following is the formula on which I mainly rely :

Cremor Bismuthi.

Glycerine of Carbonate of Bismuth (B.P.C.)	20 minims (1·2 c.c.)
Solution of Pancreatin (B.P.)	10 minims (0·6 c.c.)
Bicarbonate of Soda	5 gr. (0·325 gm.)
Tincture of Rhubarb	4 minims (0·25 c.c.)
Emulsion of Petroleum (Semprolin) to make	1 fluid drachm (3·5 c.c.)

Dosage : A dose of this should be given immediately before each feed.

Stomachic Mixture.

The following mixture is useful to improve the appetite, and for the general toning up of the digestive system :

Bicarbonate of Soda	5 gr. (0·3 gm.)
Tincture of Nux Vomica	1 minim (0·06 c.c.)
Tincture of Rhubarb	3 minims (0·18 c.c.)
Tincture of Cardamoms	5 minims (0·3 c.c.)
Tincture of Ginger	5 minims (0·3 c.c.)
Syrup of Orange	20 minims (1·2 c.c.)
Compound infusion of Gentian to make	1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) before each feed.

Gastric tonic to improve appetite in cases of hypochlorhydria :

Dilute Hydrochloric Acid	10 minims (0·6 c.c.)
Elixir of Pepsin (B.P.C.)	10 minims (0·6 c.c.)
Tincture of Cardamoms	5 minims (0·3 c.c.)
Compound infusion of Gentian to make	1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) before meals three times daily.

Carminative Mixture.

The following mixture is suitable for restless infants suffering from wind or colic :

Compound Tincture of Cardamoms	10 minims (0·6 c.c.)
Tincture of Ginger	5 minims (0·3 c.c.)
Bicarbonate of Soda	5 gr. (0·325 gm.)
Glycerine of Carbonate of Bismuth (B.P.C.)	½ fluid drachm (1·75 c.c.)
Chloroform water to make	1 fluid drachm (3·5 c.c.)

To this may be added 5 minims (0·3 c.c.) of Compound Spirit of Ether (Hoffmann's Anodyne) if thought desirable, to increase the antispasmodic effect.

Dosage : 1 fluid drachm (3·5 c.c.) as required.

Diarrhœa

The most valuable drug in the Pharmacopœia for the treatment of diarrhœa is in my opinion castor oil. It owes its valuable properties to the reactionary constipation which it sets up after its initial purgative action by which irritating matter is cleared out of the bowel. It should not however be administered more than once, and should be followed up by some ordinary anti-diarrhœa mixture such as the following :

Glycerine of Carbonate of Bismuth (B.P.C.)	½ drachm (1·75 c.c.)
Aromatic Powder of Chalk	10 grains (0·6 gm.)
Camphorated Tincture of Opium	2 minims (0·12 c.c.)
Syrup of Orange	20 minims (1·25 c.c.)

Water to make 1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) before each feed.

Astringent Mixture for Diarrhœa.

Subnitrate of Bismuth	10 gr. (0·65 gm.)
Tincture of Catechu	5 minims (0·3 c.c.)
Syrup of Orange	20 minims (1·2 c.c.)

Water to make 1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) before each feed.

Constipation

Petroleum Emulsion.

As an aperient, petroleum in the form of emulsion is without a rival when the motions are hard. It is not only an excellent intestinal lubricant, but it also softens the motions by mixing with their substance. It is far better to administer petroleum in the form of an emulsion than in its simple liquid form since the latter will not mix with aqueous or solid matter, and is apt to trickle round a scybalous mass in the pelvic colon, or rectum and to be passed independently, leaving the constipated motion *in situ*. The directions for making a useful petroleum emulsion are as follows :

Liquid Paraffin (B.P.)	20 minims (1·25 c.c.)
Benzoic Acid	1/32nd gr. (0·002 gm.)
Saccharin	1/32nd gr. (0·002 gm.)
Oil of Cinnamon	1/16th minim (0·00375 c.c.)

Decoction of Irish Moss to make 1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) three times daily.

There are many excellent commercial emulsions of petroleum, of which Semprolin is one of the best. It contains 50 per cent of liquid paraffin. Petrolagar is another useful preparation. It contains Japanese Isinglass, a good form of roughage. It is much the same thing as the B.P.C. preparation, Emulsion of liquid paraffin with Agar.

Dosage : 1 fluid drachm (3·5 c.c.) once daily.

Mixture of Cascara Sagrada.

This is an excellent tonic aperient, which does not leave behind an aftermath of reactionary constipation. It is usefully combined with an emulsion of petroleum if the stools are hard.

Liquid extract of Cascara Sagrada .	15 minims (0·9 c.c.)
Liquid extract of Liquorice . .	5 minims (0·3 c.c.)
Aromatic Spirit of Ammonia . .	5 minims (0·3 c.c.)

Chloroform water to make 1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm at night (3·5 c.c.) or oftener.

Elixir of cascara sagrada (B.P.) as well as aromatic syrup of cascara (B.P.C.), are both excellent preparations which may be substituted for the above, the dose being in each case 10–15 minims, to be taken in water or petroleum emulsion. The proprietary preparation Cascara Evacuant also combines well with a petroleum emulsion: the dose should be 5–15 minims (0·3 to 0·9 c.c.).

Compound Syrup of Figs.

This is a mild aperient, the therapeutic properties of which depend more on its senna content than on that of any other constituent drug. It has little tendency to cause a reactionary constipation.

Tincture of Aloes	3 minims (0·2 c.c.)
Tincture of Belladonna . . .	1 minim (0·06 c.c.)
Tincture of Nux Vomica . . .	1 minim (0·06 c.c.)
Syrup of Senna	½ drachm (1·75 c.c.)

Syrup of Figs to make 1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) at night.

Aperient Mixtures

Salines

White Mixture.

This aperient mixture is suitable for a daily morning draught, and especially for children over 1 year of age.

Sulphate of Magnesium . . .	20 gr. (1·2 mg.)
Carbonate of Magnesium . . .	2 gr. (0·13 mg.)
Simple Syrup	20 drops (1·25 c.c.)

Peppermint water to make 1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) first thing in the morning, with water.

Effervescent Carlsbad Powder.

This powder when mixed with water constitutes a useful and agreeable aperient for children over 1 year of age who are liable to constipation and symptoms of acidity. It is made as follows :

Sodium Sulphate (dried) . . .	1 oz. 192½ gr. (41·0 gm.)
Sodium Potassium Tartrate . .	6 oz. 35 gr. (173·0 gm.)
Sodium Chloride	210 gr. (14·0 gm.)
Sodium Bicarbonate . . .	5 oz. 122½ gr. (150·0 gm.)
Saccharin	3½ gr. (0·22 gm.)
Tartaric Acid	2 oz. 311½ gr. (78·0 gm.)

Dry the ingredients separately, powder, and mix.

Dosage : The dose is ½ drachm in 2 oz. water (1·75 gm. in 60 c.c. of water) first thing in the morning.

Cream of Magnesia.

This liquid preparation of magnesia is practically the same as that which is popularly known as milk of magnesia. It is a valuable antacid with slightly aperient qualities. It corrects gastric acidity without causing an evolution of carbonic acid gas, an objection to the administration of carbonate of soda, and most other alkalies in acid conditions of the stomach. It is an aqueous solution of dehydrated magnesium oxide and is known officially as mixture of magnesium hydroxide (B.P.C.).

Dosage : ½ fluid drachm (1·75 c.c.) to be given every morning, with or without water.

Intestinal Toxæmia

Lactic Acid Ferments or Curdled Lactic Acid Milk.

Lactic acid organisms for combating intestinal toxæmia, or for effecting changes in the bacterial flora of the bowel, can be administered in any of the following forms :

1. Sour milk, which can be obtained from most dairies.
2. Emulsions of the Bacilli.
3. Dried preparations of the Bacilli in the form of tablets.

Lactic curdled milk is supplied in a convenient form in pint and half-pint bottles by L. A. Hindley & Co., 23, Babbacombe Road, Bromley, Kent. It is sold under the name of " Bulgolac," and should be given to the extent of about half a pint daily.

A good emulsion of the bacillus Acidophilus can be obtained from Messrs. D. H. Spicer & Co., Ltd., 72, Wigmore Street, London, W.1. It can be obtained in tablet form under the names of " Trilactine," " Sauerin," or " Lactobacilline." It is important when using these dried preparations to test their activity by incubating them in milk at a temperature of 100° F. for 8 to 12 hours. If the bacillus is active the milk will curdle and smell strongly of lactic acid.

Specially coated Trilactine tablets which do not readily dissolve in the stomach are available for administration by mouth. They are useful in cases of intestinal toxæmia, but cannot be swallowed by very young children. They should be taken with plenty of milk sugar. The dose is 1 tablet three times a day for a week. When administered to children the tablet should be crushed and given in a teaspoonful of syrup or milk.

To make lactic curdled milk domestically, thoroughly sterilize 1 pint of milk by prolonged boiling : cool down to a temperature of 100° F. Crush a tablet of active lactic acid bacilli, and mix thoroughly with the milk. Keep at this temperature for 8 to 12 hours. The dose is 5–10 oz. daily (142·5 c.c. to 285 c.c.).

Note. It has recently been suggested that lactic acid organisms of human origin are more suitable for altering the intestinal flora than those derived from cow's milk or other animal sources.

Creosote.

It is not feasible to give creosote in capsules to young children. It can however be given conveniently in suspension in emulsions of cod-liver oil or petroleum, and in this form children soon get used to it and take it well in large dosage. In using the intensive creosote method I usually begin with 1 drop of creosote in each drachm of emulsion, and gradually increase the dose to 10 to 20 minims (0·6 to 1·25 c.c.). It is convenient to dispense the creosote in a drop bottle. The best results are not attained until large doses are reached. When the dosage of creosote reaches 10–15 minims (0·6 to 0·9 c.c.) the stools should become almost odourless and there should be a strong odour of the drug given off by the skin and lungs. If the increase in dosage is too rapid, the urine may become smoky, and if this stage is reached the dosage should be reduced until the carboluria has disappeared. The formula for the suspension is as follows :

Creosote (B.P.)	1–20 minims	(0·06–1·25 c.c.)
Hypophosphite of Soda . .	1 gr.	(0·065 gm.)
Glycerophosphate of Calcium .	1 gr.	(0·065 gm.)
Emulsion of Cod-liver Oil to make 1 fluid drachm		(3·5 c.c.)

Dosage : One drachm (3·5 c.c.) to be given three times a day, immediately after meals.

Mineral Depletion

Mixed Salts. (Nutritive Salts (E.P.) Parke Davis & Co.)

To ensure an adequate supply of all the mineral elements required to maintain normal nutrition a certain amount of them should be given independently of the diet, since the latter may not contain sufficient. To my prescription Messrs. Parke Davis & Co. have made up a useful little triturette of the following formula, which contains representatives of most of the necessary minerals.

Calcium Carbonate	134	parts
Magnesium Carbonate	20	,,
Sodium Carbonate	34	,,
Potassium Carbonate	141	,,
Phosphoric Acid	34	,,
Hydrochloric Acid	50	,,
Sulphuric Acid	9	,,
Citric Acid	111	,,
Citrate of Iron	6	,,
Potassium Iodide	0·02	,,
Sulphate of Magnesium	7	,,
Sodium Chlorate	0·24	,,
Potassium Aluminate	0·245	,,

Each triturette contains 15 grains (1 gm.) of the mixed salts, which for ordinary circumstances is sufficient to make good the usual mineral deficit in the 24 hours' food supply. It is best given first thing in the morning, with orange-juice, sugar and water.

Anti-Pyretic Mixtures

All diaphoretic drugs, such as those referred to below are also febrifuge in effect, in that they cause perspiration and evaporation at the skin surface, and thus reduce bodily temperature, but certain drugs act directly on the heat-regulating centres without stimulating the sweat glands. Quinine is a notable instance of this. In the case of infants and children a combination of caffeine with phenacetin acts promptly and efficiently. For more sustained action, the salicylates or acetylsalicylic acid are more satisfactory.

Diaphoretic Mixture.

The best and simplest method of inducing sweating in infants and young children is to give them a large dose of sweet spirits of nitre in hot water. For this purpose ½ drachm (1·75 c.c.) is not too large a quantity. It probably will not have to be repeated. The following is a useful diaphoretic mixture:

Tincture of Jaborandi	15 minims	(0·9 c.c.)
Nitrate of Potassium	4 gr.	(0·25 gm.)
Solution of Acetate of Ammonium	20 minims	(1·2 c.c.)
Salicylate of Sodium	2 gr.	(0·13 gm.)
Caffeine	1/8th gr.	(0·008 gm.)
Syrup of Orange	10 minims	(0·6 c.c.)

Water to make 1 fluid drachm (3·5 c.c.)

Dosage: 1 fluid drachm (3·5 c.c.) to be given at once and repeated every 2 hours until sweating occurs: it can be given in hot water.

Diuretic Mixture

The best drugs to induce diuresis in infants and young children are digitalis, caffeine, theobromine, and sodium salicylate. A combination of the two latter drugs is generally known as diuretin. With any form of disease of the kidney, drugs which increase the urinary secretion must be used with caution. The following is a useful mixture:

Caffeine	1/8th gr.	(0·008 gm.)
Tincture of Digitalis	1 minim	(0·06 c.c.)
Theobromine and Sodium Salicylate	4 gr.	(0·25 gm.)
Simple Syrup	20 minims	(1·2 c.c.)

Fresh infusion of Buchu (B.P.) to make 1 fluid drachm (3·5 c.c.)

Dosage: 1 fluid drachm (3·5 c.c.) to be given every 6 hours.

GENITO-URINARY SYSTEM

Nocturnal Enuresis

For a child of 4 years :

Bromide of Ammonium	5 gr.	(0·325 gm.)
Solution of Arsenic	5 minims	(0·3 c.c.)
Tincture of Belladonna	5 minims	(0·3 c.c.)
Simple Syrup	20 minims	(1·25 c.c.)

Peppermint water to make 2 fluid drachms (7 c.c.)

Dosage : 2 fluid drachms (7 c.c.) three times daily.
If necessary the dosage may be increased up to the limit of tolerance.

For Urethritis.

To render urine alkaline and relieve spasm :

Sodium Bicarbonate	5 gr.	(0·3 gm.)
Potassium Citrate	5 gr.	(0·3 gm.)
Syrup of Orange	20 minims	(1·2 c.c.)
Tincture of Hyoscyamus	10 minims	(0·6 c.c.)

Peppermint water to make 1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) three times a day.

Bacilluria, Pyelitis, and Coli Infections of the Urinary Tract

These conditions may be treated either by alkaline or acid medication, or possibly better by the two methods alternating at periods of 3 weeks or a month.

Alkaline Treatment.

Citrate of Soda } Citrate of Potash }	of each 5 gr.	(0·325 gm.)
Simple Syrup	20 minims	(1·25 c.c.)

Peppermint water to make 1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) three times a day.

Acid Treatment.

Acid Sodium Phosphate	5 gr.	(0·325 gm.)
Hexamine	4 gr.	(0·26 gm.)
Simple Syrup	20 minims	(1·25 c.c.)

Peppermint water to make 1 fluid drachm (3·5 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) three times a day.

Note. In the place of hexamine, cystazol (A. & H.), which is a combination of hexamine and benzoate of soda, may be prescribed : it is useful as a substitute for hexamine in that it tends to keep the urine adequately acid, and thus ensures the liberation of formic acid in the urine.

Hexyl-Resorcinol.

This is also a genito-urinary antiseptic of great efficiency. It is particularly useful in the pyelitis of infants, and is practically the same as the proprietary preparation Kaprocol (Sharp & Dohme, London). It should be given dissolved in olive oil, as in the following prescription :

Hexyl-Resorcinol . . . . 1 fluid drachm (3·5 c.c.)
Olive Oil to make 5 oz. (140 c.c.)

Dosage : 1 fluid drachm (3·5 c.c.) three times a day.

Prontosil (Bayer).

In the short time that Prontosil has been available as a therapeutic agent a large literature has grown up round its properties and usages, which seems to show that in cases of streptococcal infection, and possibly in certain other forms of infection also, such as coli infection of the urinary tract, it has very decided merits. The drug in its original form was a red dye ; it is now supplied in a simpler and colourless form (*p*-amino-phenyl-sulphonamide) to which the name Prontosil Album has been given, which can be given conveniently by the mouth. It may be given in combination with intra-muscular injections of Prontosil (soluble) when intensive action is required.

Mode of Action. Its exact mode of action has not so far been demonstrated. It is improbable that it has any direct disinfectant influence on the growth of bacteria in the blood itself : on the other hand it is possible that it may promote the activity of the reticulo-epithelial system—or other tissue cells which are concerned in checking bacterial invasion.

Cases for which Prontosil is Suitable. All cases of streptococcal infection—more particularly erysipelas, streptococcal omphalitis, otitis, osteomyelitis, meningitis, and arthritis. It is also worth trying in cases of pneumonia, and meningitis due to other organisms, and in all forms of coli infection.

Dosage. In the majority of cases the oral administration of Prontosil Album is sufficient.

For infants under 1 year of age the dosage is $\frac{1}{4}$ of a tablet (0·5 gm. or 7·5 gr.), and for children between 1 and 5 years the dosage is from $\frac{1}{4}$ to $\frac{1}{2}$ a tablet, three times a day.

In serious cases in which intra-muscular injections are combined with oral administration, 1 c.c. of a 5 per cent solution (Prontosil soluble), supplied in ampoules should be given in addition.

Toxic Effect. Over-dosage is shown by breathlessness and cyanosis, combined with sulphohæmoglobinæmia, albuminuria,

and blood in the urine. Under such circumstances the administration of Prontosil should be temporarily suspended, and not repeated until all symptoms have disappeared.

Tetany and other Spasmophilic Conditions

Phosphorus . . . . . 1/10th gr. (0·006 gm.)
Cod-liver Oil to 1 oz. (30 c.c.).

This is a convenient way of presenting phosphorus (1 in 5000).

The quantity to be given is 1 drachm (3·5 c.c.) daily in divided doses.

Phosphorus and Cod-liver Oil Emulsion for Tetany and other Spasmophilic Conditions :

Phosphorus	1 gr.	(0·6 gm.)
Calcium Glycerophosphate . . .	1 drachm	(3·5 gm.)
Sodium Hypophosphite . . .	1 drachm	(3·5 gm.)
Cod-liver Oil	2 fluid oz.	(60 c.c.)
Gum of Acacia	a sufficiency	
Syrup of Orange	1 fluid oz.	(30 c.c.)

Water to 6 fluid oz. (170 c.c.)

To make an Emulsion :

Dosage : 1 fluid drachm (3·5 c.c.) three times daily.

Ointments

Zinc and Castor Oil Ointment with Benzoin.

A useful application for sore buttocks : it is made as follows :

Zinc Oxide	116½ gr.	(7·597 gm.)
Castor Oil	1 oz. 340 minims	(50 c.c.)
Compound Tincture of Benzoin . .	213 minims	(12·76 c.c.)
Benzoated Lard	1 oz. 222 gr.	(43 gm.)

Bismuth and Ichthyol Cream.

Useful in fissures and cracks of the anus.

Compound Tincture of Benzoin . . .	40 minims	(2·4 c.c.)
Sulpho-Ichthyolate of Ammonium . .	1 drachm	(3·5 gm.)
Glycerine of Carbonate of Bismuth . .	3 drachms	(10·5 c.c.)
Tannic Acid	40 gr.	(2·4 gm.)
Olive Oil	1 fluid drachm	(3·5 c.c.)
Lanoline	1 drachm	(3·5 gm.)

Gum of Acacia—a sufficiency to make a thick cream.
Rose water to make 1 oz. (30 c.c.)

To be dispensed in collapsible metal tube.

Eucalyptus and Boracic Acid Ointment for Hypertrophic Chronic Rhinitis :

Eucalyptus Oil	30 minims	(1·8 c.c.)
Boric Acid	1 drachm	(3·5 gm.)

Soft Petroleum to 1 ounce (30 gm.)

Eczema

Calamine Cream.

Useful in eczema and irritable conditions of the skin.

Calamine	20 gr.	(1·2 gm.)
Zinc Oxide	15 gr.	(1·0 gm.)
Lime Water, Olive Oil	of each 4 fluid drachms	(14 c.c.)
	to make an emulsion.	

Tar Ointment.

Solution of Coal Tar	50 minims	(3 c.c.)
Yellow Soft Paraffin	to make 1 oz.	(28·5 gm.)

Compound Tar Ointment.

Crude Coal Tar	2 fluid drachms	(7 c.c.)
Zinc Oxide	2 drachms	(7 gm.)
Corn Starch	1 oz.	(28·5 gm.)
Yellow Soft Paraffin	1 oz.	(28·5 gm.)

Resorcin Ointment.

Resorcin	35 gr.	(2·325 gm.)
Zinc Oxide	35 gr.	(2·325 gm.)
Bismuth Subnitrate	35 gr.	(2·325 gm.)
Tar (B.P.)	35 gr.	(2·325 gm.)
White Wax	80 gr.	(5·2 gm.)
Soft Paraffin, Hydrous Wool Fat	of each ½ oz.	(14 gm.)

The above ointment is very much like the proprietary ointment Resinol, but is not in my opinion quite such an efficacious or artistic product.

Septic Skin Conditions

Antipeol.

For the local immunization of septic skin conditions, such as eczema, ulcers, cuts, wounds, etc., Antipeol is highly suitable. It is an ointment containing a mixed anti-virus vaccine filtrate of staphylococci, streptococci, and pyocyaneus with sulpho-ichthyolate of ammonium and oxide of zinc.

Dilute Ammoniated Mercury Ointment. (B.P.C.)

Consists of equal parts of ointment of ammoniated mercury and simple ointment.

Useful as a mild antiseptic ointment for septic skin conditions.

Adrenalin and Chloretone Ointment. (P. D. & Co.)

Each ounce contains adrenalin chloride 2/5ths of a grain, and chloretone 20 gr., in a combined lanoline and petroleum base.

Useful as an astringent and anæsthetic application for inflamed and irritable conditions of the skin and mucous membranes.

Oleate of Thorium.

For very chronic cases of psoriasis, eczema, and erythema multiforme.

Oleate of Thorium . . .	2 fluid drachms (7 c.c.)
Almond Oil to make 1 fluid oz.	(28·5 c.c.)

Yellow Mercuric Oxide Ointment.

For Ophthalmic use.

Yellow Mercuric Oxide . .	35 gr.	(2·325 gm.)
Liquid Paraffin . . .	35 gr.	(2·325 gm.)
Yellow Soft Paraffin . .	3 oz. 362½ gr.	(108 gm.)

An Ointment for Chilblains.

" Capsolin " (Parke Davis & Co.) contains capsicum, camphor, turpentine, cajuput, croton oil, etc. It is supplied in collapsible tubes.

Acriflavine Cream. (Duncan.)

This cream is a combination of acriflavine (1 in 1000) and thymol, with a suitable base. It is supplied in collapsible tubes of 1 oz. and is suitable for chilblains.

Anæsthesin Ointment.

For painful wounds, ulcers, fissures, herpes, etc. An anæsthetic ointment which owes its properties to ethyl-*p*-Amino-benzoate (Benzocaine).

Benzocaine	½ drachm (1·75 gm.)
Hydrous Wool Fat to make 1 oz.	(28·5 gm.)

Whitfield's Ointment.

Compound Benzoic Acid ointment (B.P.C.) contains

5% Benzoic Acid
3% Salicylic Acid
with Paraffin and Coconut oil.

It is useful for tinea circinata and other parasitic skin conditions.

Pigments and Varnishes

Whitehead's Varnish. (*Compound Iodoform Paint.*)

Specially useful for herpetic eruptions of the buttocks.

Benzoin (powdered) . . .	2 oz.	(57 gm.)
Storax	1½ oz.	(42·7 gm.)
Balsam of Tolu	1 oz.	(28·5 gm.)
Iodoform	2 oz.	(57 gm.)
Ether	12 fluid oz.	(342 c.c.)

Alcoholic Solution of Tannic Acid for sore buttocks and the hardening of nipples :

Tannic Acid	1 drachm (3·5 gm.)
Methylated Spirit or Eau de Cologne to 1 oz.	(30 c.c.)

To be applied to the part two or three times daily and allowed to dry by exposure to air.

Styptic Collodion. (B.P.C.)

For sores at the angle of the mouth, anal fissures, etc.

Benzoin powder	131 gr.	(8·465 gm.)
Alcohol (90%)	3 fluid oz.	(85 c.c.)
Tannic Acid	3 oz.	(85 gm.)
Simple Collodion to make	20 fluid oz.	(600 c.c.)

To make 1 oz. of this varnish, take one-twentieth of the above quantities.

Nasal Bougies (*Buginaria*).

For children these should be made about 2 inches long and consist of an elastic gelatin basis. They may be medicated with various drugs; for atresia of the nostrils with catarrhal symptoms they should be impregnated with Boric and Carbolic Acid as follows:

Boric Acid	5 gr.	(0·3 gm.)
Carbolic Acid	1 gr.	(0·06 gm.)
Glycerine	2 drachms	(7 c.c.)
Gelatin	2 drachms	(7 c.c.)
Water to	1 oz.	(30 c.c.)

To be moulded into bougies 2 inches long and of quarter of an inch in diameter.

Paint Granulogen. (P. D. & Co.)

This paint is useful for chilblains and other conditions of broken skin, such as blisters. It contains chloretone, cresylic acid, etc. It forms a soft flexible coating and relieves pain, is not greasy, and is free from the macerating effect of a wet dressing. Should be warmed and painted on the skin by means of a camel-hair brush.

Embrocations

Stimulating embrocation (Parke Davis & Co.) for muscular sprains, pains, and deep-seated inflammations consists of camphor, oil of origanum, ammonia, and turpentine.

Liniments

Compound Menthol Liniment.

A useful liniment to be applied over painful joints, or inflamed areas.

Menthol	1 drachm	(3·5 gm.)
Compound Camphor Liniment (B.P.C.)	of each 1 fluid oz.	(30 c.c.)
Aconite Liniment (B.P.C.)		
Chloroform Liniment (B.P.C.)		

Medicated Soaps

Evans' Medicated Soaps are very useful in infectious skin conditions: "Medisoap No. 10" (Evans) contains 10 per cent ichthalmol, and can be used in the treatment of scabies, especially when there is a tendency to a general furunculosis. "Medisoap No. 19" (Evans) contains 5 per cent sulphur, and may be employed for cleaning the skin generally, when sulphur is being used, as in cases of scabies, eczema, psoriasis, or erythema multiforme.

Powders

For Toilet and other Purposes.

Dusting powders for infants should not be made of starch, but should consist of fine kaolin or talc. The varieties of ordinary dusting powders that I can recommend are Johnson's, Mennin, and Fissan (Genatosan Ltd.). All these are of good quality, and to any of them drugs with special healing properties may be added, such as oxide of zinc, iodoform, carbonate of bismuth, etc.

Antiseptic and Healing Powder.

Bismuth-formic-iodide Compound Powder (Mulford), the so-called B.F.I. Powder, is a suitable powder for antiseptic use for the dusting of wounds, wet navels, etc.

Anæsthetic Powder.

Benzocaine . . . . . 1 drachm (3·5 gm.)
Purified Talc Powder to make 1 oz. (28·5 gm.)

Useful for the dusting of painful raw surfaces.

Boro-chloretone Dusting Powder. (P. D. & Co.)

A dusting powder possessing antiseptic and analgesic properties. Each ounce contains 110 grains of chloretone and 110 grains of boric acid with an inert vehicle.

Antiseptic Lotions

Lotion of Thymol.

This lotion is a comparatively cheap substitute for the well-known and artistic proprietary preparation Glycothymoline. Details for its preparation are as follows:

Boracic Acid	12 gr.	(0·8 gm.)
Benzoic Acid	¾ gr.	(0·05 gm.)
Thymol	¼ gr.	(0·016 gm.)
Eucalyptol	¼ minim	(0·015 c.c.)
Glycerine	1 fluid drachm	(3·5 c.c.)
Rectified Spirit . . .	12 minims	(0·8 c.c.)
Liquid Cochineal . . .	1½ minims	(0·1 c.c.)

Water to make 1 fluid oz. (30 c.c.)

It should be diluted with some 4 to 8 parts of warm water for the purposes of oral or nasal douching.

A 1 per cent solution of thymol in paraffin is a useful antiseptic preparation for cleaning the scalp of babies who are affected with seborrhœa or dandruff.

Thymol . . . . . ½ drachm (2 gm.)
Pure Liquid Petroleum to make 6 fluid oz. (180 gm.)

Dettol.

This is a halogen derivative of zylenol, dissolved in a saponified mixture of aromatic oils: it is a non-toxic and non-irritant germicide.

It may be used in various strengths up to 1 in 20. Undiluted it may be rubbed into the skin to allay the irritation of gnat or mosquito bites.

Monsol.

A powerful antiseptic of the carbolic acid type, useful for general purposes. Diluted 1 in 200 it may be used for disinfecting soiled napkins.

It may be taken internally, diluted 1 in 400, or in the form of lozenges as a prophylactic against oral infection, but is hardly applicable in the case of young children.

In a strength of 1 in 200 with glycerine added it is invaluable in cases of thrush, and may be used as a substitute for the usual glycerine of boracic acid for swabbing out the mouth in cases of this infection.

Monsol . . . . . 3 minims (0·2 c.c.)
Glycerine . . . . . ½ drachm (1·75 gm.)
Water to 1 oz. (30 c.c.)

Fecto. (P. D. & Co.)

This is an aqueous solution of alkaline hypochlorites, and contains 4 per cent of available chlorine, useful as a powerful deodorant and antiseptic for suppurating wounds, ulcers, sinuses, etc., also for septic mouth conditions, and gingivitis. It should be diluted 1 in 10 for wounds, and 1 in 100 for oral or nasal use.

Dakin's Solution: (*Strong*). (Liquor Sodæ chlorinatæ Chirurgicalis: B.P.C.)

A surgical solution of chlorinated soda, very useful as an antiseptic lotion for septic wounds, the washing out of mouths, or for general purposes.

It should be diluted with about 6 parts of warm water, or normal saline, and should be made freshly.

Neo-Protosil.

A colloidal silver iodide compound, prepared with a soluble protein base. Contains 20 per cent of iodide of silver.

Useful for inflammatory conditions of the eye, nose, and throat, in 5 per cent solution.

Drops for Eye, Ear, Etc.

Guttæ.

A solution of acriflavine (1 in 1500) is useful in ophthalmia neonatorum and other ophthalmic conditions.

Acriflavine	1/3rd gr. (0·005 gm.)
Castor Oil	1 oz. . (30 c.c.)

Ear Drops. (Glycerine of Carbolic Acid with Opium.)

These drops are useful for the relief of pain in cases of earache (without any discharge from the middle ear).

Tincture of Opium	½ drachm (1·75 c.c.)
Glycerine of Phenol (B.P.) to make 1 fluid oz. .	(30·0 c.c.)

To be warmed in a teaspoon and instilled into the painful ear, which should then be plugged with cotton-wool smeared with liquid petroleum.

Iodized Phenol. (Phenol iodizatum (B.P.C.): Pigmentum Iodi Carbolicum.)

Useful for swabbing out chronic discharging sinuses, and as a local application for ring-worm of the scalp, and actinomycosis.

Hypodermic Injections, Etc.

Collosol Manganese. (Crookes.)

Useful in the treatment of skin infections, such as boils, acne, carbuncles, eczema, as well as for deep-seated coccogenic infections. (Supplied in ampoules.)

Should be injected intra-muscularly as follows:

1st Day	8 minims (0·5 c.c.)
3rd ,, ...	8 minims (0·5 c.c.)
9th ,, ...	8 minims (0·5 c.c.)
13th ,, ...	16 minims (1 c.c.)

This series of injections should be repeated if necessary after an interval of 1 week.

Colloidal Calcium with Ostelin.

Supplied in ampoules for intra-muscular injection by Glaxo Laboratories. It is useful for chilblains, and other conditions of calcium deficiency.

Dosage: 17 minims (1 c.c.) injected daily.

Gluconate of Calcium. (B.D.H.)

A sterile isotonic supersaturated solution containing 10 per cent of the salt. I have found it very useful in allergic conditions, such as urticaria, asthma, and eczema. It is supplied in 5 or 10 c.c. ampoules, and should be injected intra-muscularly every day, or every other day, in the dosage of 2 c.c. (34 minims).

Vitamin Preparations for Oral or Hypodermic Administration

Cod-Liver Oil and Malt.

Although it is now recognized that the therapeutic properties of cod-liver oil and malt are mainly attributable to their vitamin content, and that the same results are afforded by vitamin concentrates, nevertheless there are still those who adhere to the old-fashioned practice of giving both the oil and the malt in their natural form. To them the following mixtures may appeal:

A.	Malt Extract and Cod-liver Oil (Allen & Hanbury)	½ drachm (1·75 c.c.)
B.	Cream of Cod-liver Oil with Hypophosphites (Duncan Flockhart & Co.)	½ drachm (1·75 c.c.)
C.	" Kepler's " Cod-liver Oil with Malt Extract and Chemical Food (Burroughs Wellcome & Co.) .	½ drachm (1·75 c.c.)

All of these should be administered in the above doses three times daily.

Greenosan. (Bencard, Ltd.)

This Danish preparation is a polyvalent combination of Vitamins (A, B, C, D, and E), chlorophyll, lecithin, iron, and various other mineral elements. It is useful in secondary anæmia, and for all the hypovitaminoses.

Dosage: ½ tablet (3 gr. or 0·2 gm.) three times a day.

Liver Extracts

Neo-Hepatex. (Evans.)

This preparation may be administered by intra-muscular injection, 1 c.c. (17 minims) is equivalent to 250 gm. (8¾ oz.) fresh liver. The dosage is ½ c.c. (8·5 minims) daily, for 3 days, then at intervals of 7 days.

Another extract of liver for both oral and hypodermic administration is Lederle's Extract of Liver. The preparation for intra-muscular injection is specially dispensed in ampoules. The oral dosage is 1 to 3 fluid drachms (3·5 to 10·5 c.c.) daily, and that for the hypodermic injection is 5 minims (0·3 c.c.) for 4 successive days, followed by a course of weekly injections.

Another extract suitable for injection is Liver Extract (B.D.H.); 1 c.c. (17 minims) equals 50 grammes (1⅔ ozs.) of fresh liver.

Dosage: for intra-muscular injection ½ c.c. (8½ minims) daily.

Campolon. (Bayer.)

This is a specially fractionated extract of liver, supplied in ampoules for intra-muscular injection. Useful in cases of primary anæmia, sprue, night blindness, and pink disease.

2 c.c. is equal in therapeutic effect to 500 grammes of fresh liver given by the mouth.

Dosage : 20 minims (1·2 c.c.) daily for 1 week.

Yeast Preparations

A convenient method of prescribing the vitamin B complex is to order it in the form of Yestamin—a dried yeast preparation. It can be obtained either as a powder (Yestamin), or as tablets (Yestique).

The dose is 15 grains, two or three times a day, for an infant 1 year old. It should be ordered as follows :

Yestique Tablets (15 gr.)
English Grains Co.,
Burton-on-Trent.

One tablet to be taken and crushed up in a teaspoonful of milk once or twice daily.

Bone and Vegetable Broth

(To make 1 pint)

One pound of bones—any variety will serve, provided they can be broken up with a hammer or by other means. The bones should then be simmered down with 1 pint of water and half a fluid ounce of malt vinegar. The fat must not be skimmed off, and the water must not be allowed to evaporate by leaving the saucepan lid off.

At the end of 8–24 hours, a good handful of mixed vegetables should be added—green vegetables such as spinach, cabbage, and Brussel sprouts, and root vegetables such as turnips and carrots are best. The broth should simmer for half an hour or longer : it should then be strained and made up to 1 pint. No salt or other seasoning should be added.

The broth must be kept in a cool place, and should not be used if it is more than 3 days old in winter, or 1 day old in summer. When used a fair mixed sample should be taken, containing both fat and marrow layers as well as the jelly.

This soup can be given to the youngest infant, or to children of any age. One teaspoonful in each bottle is sufficient for a very young baby, and the amount gradually increased up to one tablespoonful.

Pieces of chopped liver, kidney, or other butcher's meat offal may be added with advantage, and so may Marmite or malt extract. The two latter should be added to the broth after straining—one tablespoonful of either is sufficient.

Note. An enamel-lined pan should be used for making the broth. An aluminium pan must not be used.

This broth is obtainable under the commercial name of " Bickiepeg Broth."

To Peptonize Milk

To pre-digest milk sufficiently to be of any use in cases in which there is a failure of natural digestion, the milk must be exposed to the action of the enzymes much longer than is generally believed to be necessary.

The details are as follows :

One pint of milk should be boiled and cooled down to the optimum temperature of 117° F. Into this should then be stirred 2 drachms of liquor pancreatis and 20 gr. of bicarbonate of sodium, or an equivalent amount of some other active pancreatic preparation, such as liquor pancreaticus (Benger's) ; glycerinum pancreatis (B.P.C.) ; or zymine (Fairchild).

The milk should be kept at the optimum temperature by standing it in hot water, or putting it in a thermos flask ; it should be stirred or shaken from time to time. The peptonization should be allowed to proceed for at least 1 hour, with a maximum of 3 hours, the time corresponding to the degree of failure of the natural processes of digestion. For a new-born baby, or a very ill infant, the maximum time should be allowed, and the time lessened as the natural powers of digestion improve.

On completion of peptonization, the milk should be boiled. There is no need to dilute peptonized milk, even when given to the youngest or feeblest baby.

Benger's Food.

Benger's Food which contains digestive enzymes should be prepared on the same principles as described above. That is to say, after being added to milk at a temperature of 117° F. the digestive process should be allowed to proceed with occasional stirring, for the same time as in the preparation of ordinary peptonized milk—*i.e.* for any period between 1 and 3 hours, according to the degree of failure of natural digestion.

The details are as follows :

Add 1 oz. of Benger's Food to 1 pint of milk (boiled and allowed to cool to 117° F.). Stir thoroughly, and keep at the same temperature with occasional stirring for the required period of time.

The food thus prepared need not be boiled before it is given to the child, unless it is wished to stop the action of the enzymes. It does not require to be diluted.

To Peptonize Milk with Pepsin.

With failure of gastric digestion, it is sometimes required to feed the child on milk which has been artificially predigested with pepsin in an acid medium, instead of on milk pancreatized in an alkaline medium. To fulfil this object proceed as follows :

Take 1 pint of milk, boil, and cool down to 117° F. Add 1 oz. glycerinum pepsini, or some equivalent acidulated preparation of pepsin. Stir very thoroughly, and keep at same temperature with occasional stirring for 1 to 3 hours, according to requirements. Boil, and give undiluted.

APPENDIX PART II

TECHNIQUE OF CLINICAL PROCEDURES AND PREPARATION OF MEDIA

Blood Transfusion

The method of transfusion employed at Great Ormond Street Children's Hospital is probably the simplest and the best for general use in the case of infants. It can be carried out by one individual without assistance, which greatly simplifies the operation. The necessary apparatus consists of a special metal syringe [1] of 600 c.c. capacity, which can be clamped firmly to a table in any position by means of a special standard and clips.

To obtain the blood the syringe should be partially filled with 2 per cent Citrate of Soda solution, which, along with the whole of the apparatus, must be thoroughly sterilized. The needle should be attached to the nozzle of the syringe by a sufficient length of small-bore rubber tubing, and inserted into the vein, with the bevelled edge and opening pointing downwards. As the blood flows into the syringe it should be well stirred with the citrate solution with the wooden rod provided.

For the injection of the blood the same syringe is used, but the injection needle is attached to the nozzle of the syringe by means of a special form of indiarubber tubing of 2·5 mm. internal bore, and with somewhat thick walls. A few inches from the nozzle there is a Lauries's Dropper which acts as a combined air-lock and inspection chamber. The needle is connected with this dropper by 9 in. of the same rubber tubing.

It is seldom possible in the case of babies and young children to insert the needle into the vein without previous exposure by a skin incision. For this purpose a cut about 1 in. long should be made at right angles to the course of the vessel, and into this opening a small pair of dissecting scissors should be thrust and opened out so as to separate the connective tissue and leave the vein well exposed. The needle should be inserted into the vein thus exposed, with the bevelled edge pointing downwards, and in the same direction as that of the blood flow.

It is a good plan to pour a little 2 per cent citrate of soda solution

[1] B. Browne, *Brit. Med. Journ.*, 1931, vol. i, p. 259. The apparatus is made by Down Bros., 21, St. Thomas's Street, London, S.E.1.

into the wound so as to keep the needle moist, and in addition to cover the whole of the needle and the wound with a moist antiseptic dressing. In carrying out this operation the following precautions should be taken. The donor's blood should be matched with that of the recipient by careful grouping, the

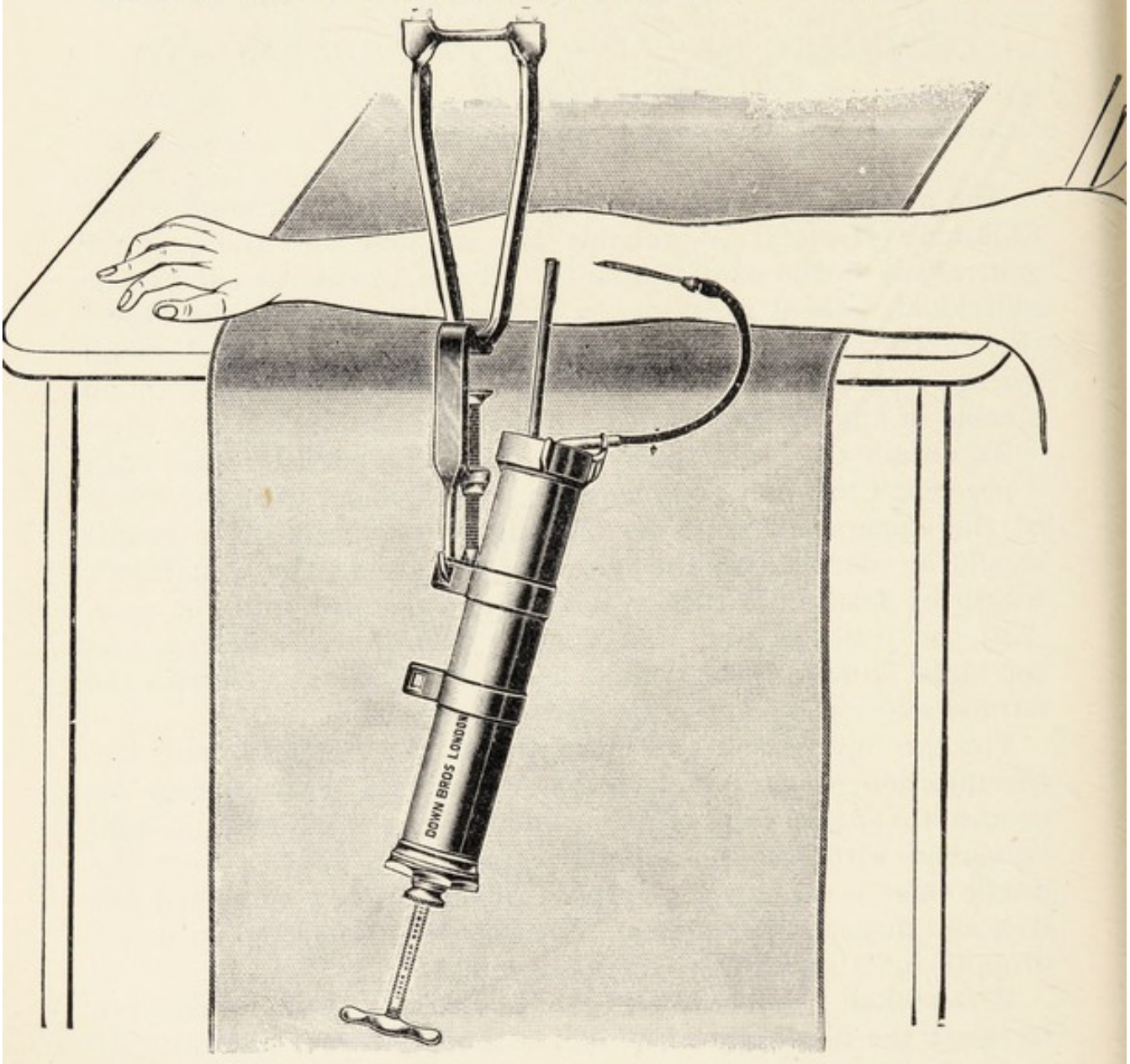

FIG. 46.—Syringe for the withdrawal of blood from donor.
(From Garrod, Ballen, Thursfield and Paterson, by permission.)

total amount of blood injected should not be more than 10 c.c. to the lb. of bodyweight of the recipient. The temperature of the injected blood should be maintained as far as possible at 99° F. The donor should be free from all infective diseases, especially syphilis, tuberculosis, malaria, and sepsis. The needle used for the injection of the blood into the recipient should have its point ground down and blunted by rubbing on a hone. For

further particulars of this method see Garrod, Batten, Thursfield & Paterson, 3rd Edition, pp. 532–9.

Citrated Blood

Dissolve 4 gm. (1 drachm) sodium citrate in 200 c.c. (7 oz.) of freshly distilled water (this gives a 2 per cent solution), and pour 3 drachms (10 c.c.) of this solution into a half-litre flask fitted accurately with a rubber cork through which pass two glass tubes bent at right angles. One of these tubes should project into the flask at least 1 in. below the level of the other. To the longer tube attach a rubber tube 6 to 8 inches long, and fitted at the distal end with a transfusion needle. To aspirate blood from the donor's vein into the flask, attach a small suction pump to the shorter glass tube. After sterilizing the skin over the selected vein of the donor, which for preference should be the median basilic, for further details see page 711, insert the needle and maintain suction in the flask by means of the pump. From 100 to 125 c.c. ($3\frac{1}{2}$ oz. to $4\frac{3}{8}$ oz.) of blood should be allowed to enter the flask. Citrated blood obtained in this way may be kept on ice for some 3 or 4 days. It should be warmed before being used, by placing the flask in a pan of warm water at a temperature of about 104° F.

Intra-peritoneal Injections

The peritoneal route is a very convenient one for the administration of various fluids in the case of dehydrated infants or those who are unable to take sufficient fluid by the mouth. By this means normal saline, Ringer's, Hartmann's, dextrose, or bicarbonate solutions may be given in any reasonable quantity. It is also possible to inject citrated blood.

The method is as follows :

A graduated gravity litre flask is connected by its lower end with 3 ft. of rubber tubing, $\frac{1}{4}$ in. internal diameter, to the distal end of which is attached a tapered glass nozzle. By a short length of tubing this nozzle is then connected with the hypodermic needle, which should be of small size. Owing to the fact that there is some little danger of the needle penetrating the intestinal wall, it is a good plan to use a transfixion needle, with the opening not at the end but in the middle. It is used in the following way —a fold of the abdominal wall is picked up between the fingers and thumb, and the transfixion needle boldly thrust through so that its pointed end projects on the far side of the fold, while its central portion with the opening lies within the peritoneal cavity. When the fold of skin is released by the hand it recoils to its previous position and leaves the central part of the needle well

within the abdominal cavity. The gravity apparatus, which should have been sterilized with its contents, is suspended 2 ft. above the patient's head, and after the needle has been inserted and precautions have been taken to see that there is no air-locking in the tubing, the fluid should be allowed to flow slowly into the abdomen. As much as 400 c.c. may be injected by this means, but the amount should not be so great as to produce over-distension of the abdomen or respiratory distress. The injection may be repeated after 12 hours.

Subcutaneous Injection

This is a simple and efficient method of injecting fluid into dehydrated infants. The operation may be repeated as long as the fluid is absorbed. It must be stopped when the point of saturation is reached. It is usual to inject between 50 and 70 c.c. at a time into the subcutaneous tissues of the back below the angle of the scapula, into the buttocks, or into the thighs. The site of injection should be changed every time the operation is repeated. The abdominal wall should not be used because of the resulting pain and interference with respiration. The method of injection, and the apparatus is the same as that used for intra-peritoneal injection, except that an ordinary hypodermic needle can be employed.

Saline Transfusion

(Superior longitudinal sinus route)

If the fontanelle of the infant is still open, saline solutions, but not blood, may be introduced into the circulation through the superior-longitudinal sinus. The details of the operation are as follows :

The skin over the anterior fontanelle should be shaved and rendered sterile by cleaning with ether and alcohol and then painted with tincture of iodine. The needle should be attached to the syringe by means of a short length of rubber tubing, and an adaptor should be secured by a Moncrieff's wedge which has a metal centre through which the needle passes and projects for about 3 mm. beyond the extremity of its bevelled end. This wedge acts as a check to prevent the needle passing too far through the wall of the sinus and perforating the distal wall, and at the same time helps to maintain the needle at the correct angle which is about 45°, with the horizontal. The needle should be directed backwards and two operators are required, one to steady the head, and one to hold the body, subsequently the puncture hole should be sealed with a piece of gauze saturated with collodion.

Continuous Saline Transfusion [1]

(The Drip method of Transfusion, Venoclysis)

The introduction of the method of continuous saline transfusion promises to become a very valuable form of treatment in cases of dehydration or acidosis in infants. Various media may be used for the transfusion, such as normal saline, 10 per cent glucose, 4 per cent bicarbonate of soda, citrated blood, Ringer's solution, or Hartmann's solution.

The technique is as follows :

A gravity flask fitted at the lower end with 1 ft. of rubber tubing $\frac{1}{4}$ in. in internal diameter, which should have a glass inspection chamber, and a screw clamp ; to the distal end of this tube is attached a Murphy drip, namely a glass tube 6 in. long and 1 in. internal diameter, tapered at the lower end so as to fit the $\frac{1}{4}$ in. rubber tubing, and fitted tightly at the upper end with a rubber cork in which two holes have been bored. In one of these is inserted a piece of glass tubing 3 in. long and $\frac{1}{4}$ in. internal diameter, which serves to connect the lower end of the rubber tubing attached to the gravity flask. The tapered lower end of this Murphy drip is fitted with a 3-ft. length of rubber tubing $\frac{1}{4}$ in. internal diameter, to the distal end of which a Hendon's gold-plated needle or one of its modifications is fitted. Before use the whole of the apparatus must be sterilized.

The veins in order of choice for continuous transfusion are the arm (median basilic), ankle (internal saphenous), scalp, and external jugular, but not the longitudinal sinus, even though the anterior fontanelle is still open. The skin over the vein selected should be cleaned by the application first of iodine (tincture), and then of alcohol, and the vein should be cut down on and exposed for about $\frac{3}{4}$ in., for details see page 711, and the needle inserted in the direction of the blood flow. It should be maintained in position by strapping. A few drops of solution of 2 per cent citrate of soda should be poured into the wound so as to wet the needle, and the limb should be immobilized by means of a splint. It is essential to have a special nurse to regulate the flow of the fluid, and to see that the flask does not become empty.

The temperature of the fluid in the flask should be about 105 ° F. and the amount of the fluid to be transfused must be regulated by means of the screw clamp : 15 drops per minute of the Murphy drip represents a rate of flow of about 60 c.c. ($2\frac{1}{8}$ oz.) per hour. A rate of 30 c.c. (1 oz. approximately) per hour is usually rapid

[1] F. B. Ramsay, *Surg. Clin. N. Amer.* and *Med. Ann.*, 1934, p. 417, and 1933, p. 631.

enough for a dehydrated baby of 1 year, and the transfusion may be continued for as long as 2 days.

Continuous subcutaneous injections may be given more simply

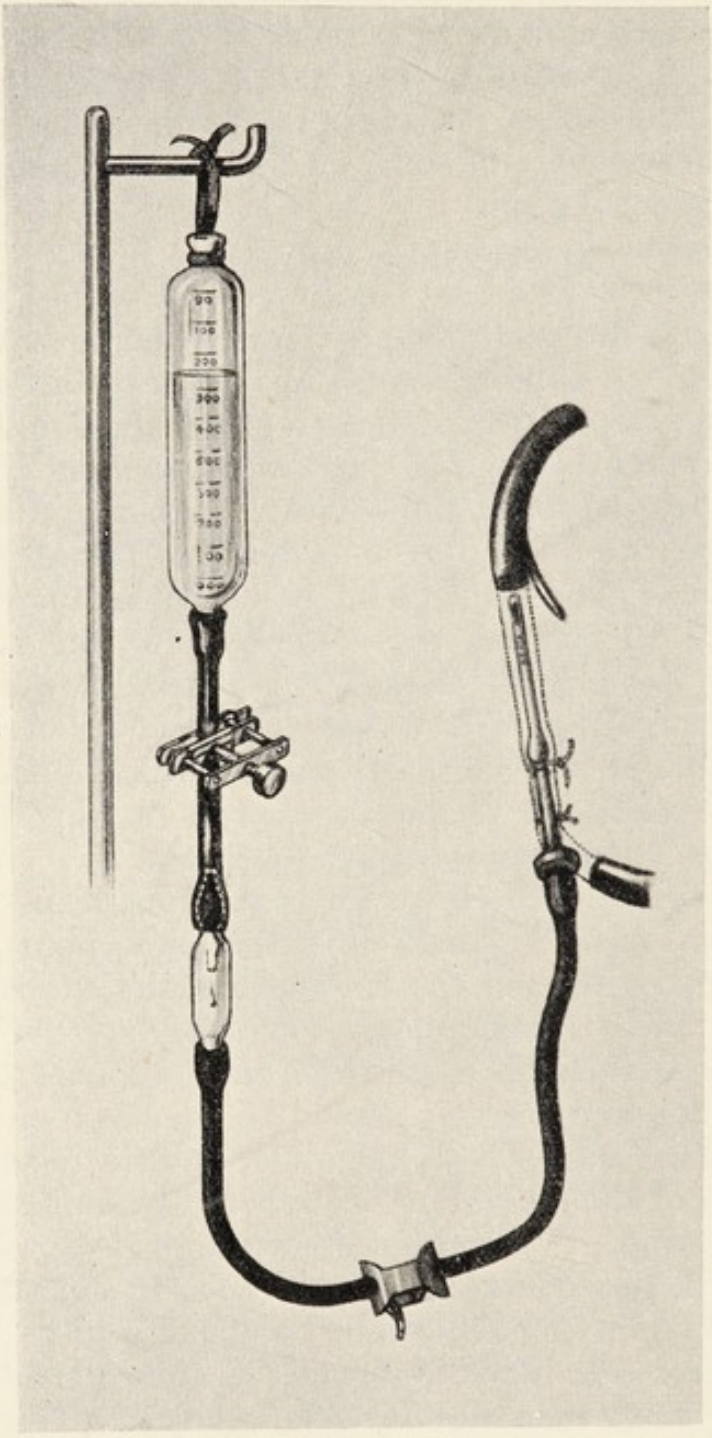

FIG. 47.—Apparatus for Continuous Transfusion—Drip Method.
(From *Year Book of Treatment*, 1934, by permission of John Wright & Son, Bristol.)

by using a gravity flask outfit, consisting of a graduated litre gravity flask, fitted at the lower end with a 3-ft. rubber tubing $\frac{1}{4}$ in. internal diameter, to the distal end of which a tapered glass nozzle is attached. A short bevelled needle 2 in. long is fitted

to 3 ft. of rubber tubing $\frac{3}{16}$ in. internal diameter, and attached to the lower end of the glass nozzle. A sterile dressing should be kept over the needle when in use, and also over the top of the gravity flask, and arrangements should be made for keeping the fluid in the flask at the required temperature—about 105° F.

PREPARATIONS OF MEDIA FOR CONTINUOUS TRANSFUSION

Normal Saline

Physiological or normal salt saline is made by dissolving 9 gm. ($2\frac{1}{4}$ drachms) of sodium chloride in 1,000 c.c. ($1\frac{3}{4}$ pints) of freshly distilled water. The solution should be run through filter paper, sterilized, and kept in a well-stoppered flask. It should be used fresh.

Glucose Solution

10 per cent glucose solution is made by dissolving 25 gm. ($6\frac{1}{2}$ drachms) of dextrose in 250 c.c. ($8\frac{4}{5}$ oz.) of freshly distilled water. The solution should be filtered, sterilized, and kept in a well-stoppered flask until required, and used fresh.

Bicarbonate of Soda Solution (4 per cent)

A 4 per cent sterile solution of bicarbonate of soda is made by dissolving under aseptic conditions 8 gm. (2 drachms) of pure sodium bicarbonate in 200 c.c. (7 oz.) of sterile normal saline (see above) after it has been thoroughly cooled. The solution must not be heated for the purposes of sterilization.

Ringer's Solution

Dissolve 7 gm. (3 drachms) of sodium chloride, and 0·35 gm. ($5\frac{1}{4}$ grains) of potassium chloride, and 0·026 gm. ($1\frac{1}{2}$ grains) of calcium chloride in 1 litre (1·76 pints) of freshly distilled water. Pass through filter paper and keep in a sterilized flask. This solution may be sterilized by heat.

Hartmann's Solution

To make this solution take 100 c.c. ($3\frac{1}{2}$ oz.) of an 85 per cent lactic acid solution, and dilute it with 700 c.c. (1 pint $4\frac{1}{2}$ oz.) of freshly distilled water. Add a few milligrams of dry Phenol Red, to act as an indicator, and then enough carbonate-free concentrated sodium hydroxide to neutralize the lactic acid. This mixture is now brought to the boiling-point, and kept there for 45 minutes. During this heating the anhydride of lactic acid

is hydrolysed and turns the solution a yellow colour (acid). As often as this occurs during the heating enough sodium hydroxide must be added in order to keep the solution slightly alkaline (red). After 45 minutes the hydrolysation should be complete, and at this stage the fluid remains permanently alkaline. The final volume is now made up to 1 litre (1¾ pints) with freshly distilled water, and the solution should be put into Pyrex bottles or test-tubes with their mouths plugged with cotton-wool, and autoclaved for 30 minutes at 15 lb. pressure. This solution which is somewhat difficult to make may be obtained from most of the larger drug firms under the name of "Sterile Molar Sodium *r*-Lactate Solution."

Buffered 10 per cent Sterile Glucose Solution

This solution which is a very valuable one for intravenous use in cases of gastro-enteritis with acidosis and dehydration, is so difficult to make that it is better to procure it ready-made from the manufacturing chemists.

For Intra-Arterial Injection

Pregl's Concentrated Iodine Solution.

This solution is ten times as strong as the unconcentrated, and is the only form in which Iodine should be used for intra-vascular injection. It is usually supplied in 5 and 10 c.c. sterile ampoules. The contents of a 5-c.c. ampoule may be injected into the common carotid artery, followed by cisternal drainage for four consecutive days in cases of pneumococcal meningitis. Cisternal injections of anti-pneumococcic serum and 5 to 8 c.c. of complement, may be administered at the same time. Complement should take the form of fresh sterile Wassermann-negative Human Serum.

Acriflavine Solution.

For intra-arterial injection (common carotid artery) in cases of pneumonic or influenzal meningitis. It should be followed by cisternal puncture, and the withdrawal of an equal quantity of cerebro-spinal fluid. The injection should be repeated at intervals of 2 days for four injections.

The strength of the solution should be 0·5 per cent in normal saline, and the quantity injected 10 c.c.

TOLERANCE TESTS

Sugar

Sugar tolerance tests can be carried out in the case of dextrose, galactose, or lævulose. The dextrose test is useful for gauging

the functional efficiency of the pancreas, pituitary, liver and kidneys. The galactose test shows the functional efficiency of the liver, and so does the lævulose test.

Dextrose or Glucose Tolerance Test

This test is carried out in the following manner:

After fasting for 12 hours—that is to say, first thing in the morning before breakfast—the child is given the prescribed quantity of sugar (glucose) in a sufficient quantity of water and lemon-juice to render it palatable. The quantity of sugar to be given is generally reckoned on a basis of 1·5 to 1·75 gm. per kilogram of bodyweight, or about 12 gr. per lb. of bodyweight. Thus a child weighing 15 kilograms or about 34 lb. in weight should be given 28 gm. of glucose in 90 c.c. of water, or about 1 oz. of glucose in 3 oz. of water, to which has been added $\frac{1}{4}$ oz. of lemon-juice.

In a normal child no dextrose appears in the urine, and the blood sugar curve will rise from a fasting level of between 70 to 110 mg. (0·035 drachms to 0·05 drachms) to 140 mg. (0·07 drachms), per 100 c.c. ($3\frac{1}{3}$ oz.) of blood, and return to the fasting level in 3 hours' time.

In diabetic cases dextrose appears in the urine within 3 hours, and the blood sugar curve rises more rapidly than normal for over 3 hours. In diabetes insipidus the blood sugar curve is normal. In hyperthyroidism and hyperpituitarism, the blood sugar curve rises somewhat quicker than normal and remains at a higher level for a longer time than normal, but to a lesser degree than in the case of diabetes. In hypothyroidism and hypopituitarism, Addison's disease, and hyperinsulinism, the curve is flattened, as it is also occasionally in cases of epilepsy, and narcolepsy.

In chronic intestinal indigestion (cœliac disease) the curve only rises slowly.

Galactose Tolerance Tests

This test affords information with regard to the functional efficiency of the liver. The normal liver will utilize about 40 gm. ($1\frac{1}{3}$ oz.) of galactose in less than 4 hours so that if more than 3 gm. (45 gr.) appear in the urine within 4 hours of ingestion, the implication is that the liver is damaged. The test is carried out as follows:

0·5 gm. of galactose per kilogram (or about $3\frac{1}{2}$ grains per lb.) of bodyweight is given in 200 c.c. (7 oz.) of water by the mouth after 12 hours' starvation. Urinary specimens are collected before

the experiment begins, and also 2 and 4 hours afterwards. The urine is tested quantitatively for reducing sugar. The figures obtained in these tests should be multiplied by 1·5 in order to make a correction for the difference between the reducing power of galactose and dextrose. In patients who have catarrhal jaundice, more than 3 gm. (45 gr.) of galactose appear in the urine in less than 4 hours, but not in the case of those who have obstructive jaundice.

Lævulose Tolerance Test

After 12 hours' starvation the child should take 0·75 gm. (0·193 drachms) of lævulose per kilogram of bodyweight (or 6 gr. per pound), dissolved in 100 c.c. ($3\frac{1}{3}$ oz.) of water. Samples of blood for sugar estimation should be taken immediately before drinking the lævulose, and at 30-minute intervals during the next 2 hours. In normal children the blood sugar level does not rise more than 10 mg. (0·15 gr.), per 100 c.c. ($3\frac{1}{3}$ oz.) of blood during this period, but in those with damaged livers the increase is as high as 75 mg. (1·1 gr.), per 100 c.c. ($3\frac{1}{3}$ oz.) of blood, the extent of the rise is proportional to the liver inefficiency.

DESENSITIZATION OF THE HYPERSENSITIZED CHILD

It is only in special cases that the specific desensitization of allergic children is either possible or feasible. It is only in those cases in which the child is particularly sensitive to some known allergen to which he is frequently or compulsorily exposed that such prophylactic treatment is justifiable. Exceptional cases are those which occur in connection with seasonal asthma, or hay fever, or in those special circumstances in which a child who requires re-inoculation with serum happens to be sensitive owing to previous inoculation.

Children who suffer from the ordinary allergic diathesis, namely, the so-called eczema-prurigo-asthma syndrome, are usually hypersensitive to so many different allergens or varieties of stimuli both physical and psychological, that it would be useless to attempt to deal with each susceptibility individually. Children of this type are better treated on general constitutional lines which aim at stabilizing the nervous system and rendering it less liable to react violently to any kind of stimulus.

A good deal can be done to protect children of this type by treating any existing intestinal toxæmia, and by giving nerve sedatives, mineral salts, and vitamins. They should also be

protected from all psychological and physiological events which are likely to cause fatigue, excitement, or functional disturbance.

The precise characters of the allergens to which children are hypersensitive can be determined by actual tests. The usual practice is to inoculate the skin with some of the suspected material and observe the reaction which follows within a specified period of time, generally from 20 minutes to half an hour. A positive reaction is evidenced by a definite erythematous induration or wheal which exceeds 1 cm. in diameter. The skin tests may be dermal, intradermal, or consist in the simple local application of a gauze patch saturated with a solution of the substance under suspicion, without previous scarification of the skin. The test may also be carried out by the application of the suspected material in solution, or in powder form, to the mucous membrane of the eye (ophthalmic test), nose (nasal test), or the mouth (oral test). The preparation of the extract or solution for testing hypersensitiveness had better be left to an expert, though it may be made as a home preparation with the expenditure of some little trouble. To desensitize a child who evinces sensitiveness to specific allergens, one of the following methods may be employed :

1. The massive or rapid.
2. The gradual.
3. Ingestive.

1. The Massive or Rapid Method.

This method is mainly used for the immediate desensitization of children who are sensitive to horse serum, and who require a further injection. The initial dose should be given intradermally. As a general rule, very diluted solutions are used for this purpose, 1 in 100 or even 1 in 100,000, according to the degree of skin sensitivity. The serum or allergen solution for the initial desensitization injection of the child should be 100 times as dilute as that which gives a well-marked positive skin reaction.

Subsequent injections should be given at intervals of 15 to 20 minutes, and they should be made progressively stronger and larger until the desired quantity is attained. At first the injections should be given hypodermically, but when they attain to a large size they may be given intra-muscularly, or even intravenously.

The reactions or anaphylactic shock are counteracted by a hypodermic injection of ephedrine 2 minims (0·13 c.c.) of a solution of epinephrine-hydrochloride (1 in 1,000). If a reaction occurs the succeeding injection should be smaller, and each

succeeding dose must be taken without discomfort before the amount, or the strength of the desensitizing lotion is increased.

2. The Gradual Method.

This slower method of desensitization is similar to the foregoing, but the initial dilutions are very high—(1 in 1,000,000 or 1 in 1,500,000) and the injections are given with an ordinary hypodermic syringe at two- or three-day intervals.

3. Ingestive Method.

This method applies to the desensitization of children who show allergic reactions to particular foods, such as egg white, for instance. The method of desensitization against the latter food is as follows :

Mix 1 tablespoonful of white of egg in 5 oz. of water. Give 1 drop of this by the mouth on the 1st day, 2 drops on the 2nd day, and so on in increasing amounts until the child is able to take undiluted white of egg without sickness or other reaction. Desensitization once established is generally permanent.

Desensitization against pollen or other allergens which produce symptoms of hay fever, or asthma, must be undertaken some months before the expected symptoms are likely to develop, and repeated every year, for at least 3 or 4 years. The results are so reliable and so good that the trouble is well repaid.

Oxygen Inhalations

For a full account of oxygen therapeusis, the reader is referred to an article by W. R. Potts.[1] For ordinary purposes of administration to infants, the following apparatus serves admirably. It consists of a litre flask with a two-holed cork ; through one hole passes a glass tube, which reaches nearly to the bottom of the flask and serves as the supply tube. It is attached at its upper free end to a sufficient length of rubber tubing, which is connected with the nozzle of the supply cylinder. The flask itself should be about half-full of warm water or water and brandy, and through this the oxygen bubbles at a rate which can be regulated in accordance with the requirements. The oxygen is delivered to the child by means of a fine catheter which is connected with the other glass tube, which passes through the second hole in the cork, by means of a further length of rubber tubing. The catheter is passed about 1 in. into one of the nostrils and fixed in position by adhesive strapping. The rate of flow for ordinary purposes is about 1 bubble per second. An inverted glass funnel may be substituted for the catheter and held in position by a clip. The hands of the child must be restrained.

[1] W. R. Potts, *Amer. Jour. Med. Sci.*, 1932, p. 616.

The same apparatus serves for the administration of carbon dioxide (5–10 per cent) in combination with oxygen, especially in the case of asphyxiated new-born babies.

For severe cases an oxygen tent may be substituted for the above. It is possible to extemporize a suitable tent after the usual type used for a steam tent, but a new form of tent described by E. P. Poulton,[1] is very much better.[2] A completely assembled mobile oxygen therapy machine is also supplied by the Oxygenaire Co., Ltd.,[3] and is very efficient and accurate in the delivery of oxygenated air of the required humidity and temperature.

Steam Tent

A simple steam tent may be improvised by placing a rod or pole along the length of the cot at about 3 ft. above the level of the child. Over this is hung a double sheet or blanket the ends of which are pinned together at the head and foot of the cot. A window of the required size must be left at one side of the cot. A bronchitis kettle which discharges steam at the foot of the bed, and at a sufficient distance from the child to be free from risk of scalding is effective. Electric kettles are a great convenience. Failing a proper bronchitis kettle an ordinary kettle fitted with a long paper cone serves the purpose quite adequately. The child should be carefully watched to prevent accidents.

Lavage

For washing out the stomach, the following apparatus is required : a soft rubber catheter, with a large eye : a glass funnel capable of holding 4 to 6 oz. and 2 ft. of rubber tubing to connect the two. The child should be placed in the sitting position, the catheter lubricated with glycerine, and then passed rapidly through the pharynx into the œsophagus. About 10 in. of the catheter should be passed beyond the lips, and when it has reached the stomach the funnel should be raised to allow the escape of gas. The funnel is then lowered, and the fluid contents of the stomach syphoned off. If the stomach can be emptied by this means, well and good, but if the contents are too thick, they must be diluted by pouring warm water or saline solution into the funnel after elevation. The funnel is then lowered and the dilute contents syphoned off. This process is repeated until the fluid returns clear.

[1] E. P. Poulton, *Lancet*, 1933, vol. i, p. 244.

[2] It may be purchased or hired from Messrs. Siebe Gorman & Co., Ltd., 187, Westminster Bridge Road, London, S.W.1.

[3] 10A, Harrow Road, London, W.2.

Gavage

Forced feeding with liquids can be carried out by means of the apparatus above described. When the tube has entered the stomach, the funnel is raised to allow the escape of gas, and the food is then poured into the funnel. As soon as the funnel is empty, the tube is tightly clamped and withdrawn. After gavage the child should be kept quiet on his back for some time. If the food is vomited, as sometimes occurs, a second feed must be given. This method of enforced feeding is in my opinion very much better than the following.

Nasal Feeding

The same apparatus is required, but the catheter should be of smaller calibre. The catheter should be well oiled and passed boldly along the floor of the nose to the back of the pharynx. This method is sometimes used in cases of so-called pyloric stenosis. I have never seen any advantage from its use in this connection, and as a substitute for the direct method of gavage, in my opinion it is a failure.

Lumbar Puncture

In performing lumbar puncture the hands of the operator should be very thoroughly washed and scrubbed, and then rinsed in a 70 per cent alcohol solution, dried with a sterile towel, and finally protected by sterile rubber gloves. The exact spot into which the exploratory needle is to be inserted should be determined before the skin of the patient is sterilized. This spot should be marked with an aniline pencil; the position is found by drawing an imaginary line from the two iliac crests: where this line crosses the vertebral column is the level at which the needle should be inserted. The depression between the two vertebral spines which most nearly corresponds with this level should be felt with the finger and marked with the pencil. This point is usually the interspace between the 3rd and 4th lumbar vertebræ. The skin for 2 or 3 inches round should be painted with tincture of iodine, and covered with sterile gauze, with a window in it sufficiently large to allow of the operation being easily carried out. The position of the patient should be on his side over the edge of a non-sagging bed or table. The patient's head and knees should be approximated as closely as possible by an assistant who places one arm round the neck and the other round the knees. This will flex the spine and tend to open out the intervertebral spaces. The broad span of the patient's back should be quite vertical—that is to say, the upper

shoulder should not be allowed to incline forward. Before inserting the exploring needle, it should be carefully examined to see that it is quite sound and flexible, and that the stilette is not rusty. To insert the needle, it should be held absolutely perpendicularly to the broad span of the back and inclined slightly towards the head of the patient. The needle should then be gently pushed on, until it has entered the canal and can be freely moved in various directions. The stilette should then be removed and the required amount of fluid drawn off. The stilette should not be reinserted after the fluid is withdrawn, but the needle should be removed and its point of exit sealed with a collodion dressing.

The following precautions should be taken :

(1) Lumbar punctures are contra-indicated if a brain tumour or abscess is suspected.

(2) If the point of the needle on being inserted impinges on bone, the needle should be incompletely withdrawn so that the point is just below the level of the skin, and it should then be reinserted in a new direction.

(3) If by any chance the needle should break off, the skin should be nicked with a sterile scalpel and the broken end of the needle sought for and seized with a pair of sterile forceps. If this fails, the patient should be given an anæsthetic, and the fragment removed by a surgeon.

(4) If the child complains of pain in the leg after the operation, the needle has probably pierced a posterior root. Both " bloody " and " dry " tappings occasionally result, and in such cases it may be necessary to try other interspaces.

As for the amount of fluid to be withdrawn, 1 c.c. is sufficient for a culture : $1\frac{1}{2}$ c.c. for a cell count : and about 8 c.c. for a Wassermann test.

Headache sometimes follows the puncture, and should be treated by keeping the child in bed for 24 hours, elevating the foot of the bed, and giving a dose of phenacetin or acetylsalicylic acid (Aspirin).

Cisternal Puncture

For this purpose an exploring needle, which is not very flexible, and has a small hilt should be used. The bevelled edge should be directed downwards and inserted into the skin in the exact mid-line at the upper border of the first spinous process. If the needle is inserted exactly at this point, and directed slightly upwards, it will usually reach the cisterna magna without a change of course. When the needle has been pushed through the skin

and outer ligaments, the stilette is removed, and the needle is pushed steadily forwards towards the cisterna without allowing the tip to point in the least degree downwards, but always in the direction of the eyebrows in front. In order to ensure a steady and gradual movement of the needle, and to prevent it penetrating too far when it passes through the dura, it is well to hold the needle between the index finger and the thumb, keeping the remaining fingers against the child's head to obtain support. As soon as the tip of the needle passes through the dura, less than 3 cm. deep, the fluid should appear.

Tourniquet Tests

(Rumpel-Leede phenomenon)

This test is employed in the diagnosis of purpura, scurvy, and other hæmorrhagic conditions. Petechial hæmorrhages develop on the surface of the skin distal to a tourniquet, which has been applied fairly tightly to the upper arm in cases with hæmorrhagic tendency. Rubber tubing is tied round the upper arm and left in position for 10 minutes. One minute after removal, the arm distal to the tourniquet should be examined for hæmorrhage. It is a useful test for infantile scurvy, and serves as a guide to the success of antiscorbutic treatment.

The Lipiodal Method of Outlining the Bronchial Tree

Radiography of the bronchial tree mapped out with lipiodal is a very valuable means of estimating the size or degree of patency of the bronchial tubes in bronchiectasis and other lung conditions.

The method is as follows :

The child is given a general anæsthetic and 10 c.c. ($\frac{1}{3}$ oz.) of warmed lipoidal solution are injected into the trachea by piercing the crico-thyroid space by means of a special trocar and cannula. The fluid must be injected slowly, and the child raised up into the sitting position for a few minutes to enable the lipiodal to gravitate into the smaller bronchioles. The child may be turned on one side if a unilateral radiograph of the chest is required.

There appears to be no danger if the procedure is conducted on the above lines, and the lipiodal itself sometimes has quite a favourable influence on any existing bronchiectasis. The X-ray photograph may be taken any time within 6 hours of the injection of the lipiodal.

Technique of Ventriculography

The scalp is incised at a point about $2\frac{1}{2}$ inches above the external occipital protuberance and 1 inch from the median line, and a

small trephine opening made in the bone. A ventricular needle is then passed through the dura and brain substance on a level with the root of the nose and slightly outwards to a depth of about $2\frac{1}{4}$ inches; the posterior horn of the lateral ventricle should be reached. Cerebro-spinal fluid is then withdrawn and replaced by a slightly less volume of air. The quantity in a child under 5 years of age may be about 18 c.c. ($\frac{1}{2}$ oz.), but in cases of hydrocephalus may be much more. Radiographs are then taken with the head in various positions. The ventricular system is well mapped out, showing the areas of dilatation and the seat of the obstruction, and the probable position of any existing tumour.

INDEX

Abortive pleurisy, 425
Abscesses :
  intra-cranial, **544**
  mammary, **26**
Acarus, 470, 471
Achondroplasia, **586**
Acidosis, **316**
  dehydration type, 323
  renal type, 323
Acne vulgaris, **510**
Acriflavine cream, 702
  solution, 718
Acrocephaly, **588**
Acrodynia, **91**
Actinomycosis, **442**
  action of iodides in, 443
  of skin, 477
Addison's disease, **367**, 383
Adexolin, 100
Adrenal :
  cortex, diseases of, **369**
  — hormone, 367
  — tumours of, **369**
  insufficiency, **367**
  medulla, diseases of, **370**
  — tumours of, **370**
Ardenalin :
  and chloretone ointment, 701
  properties of, 367
Adrenals, **366**
Air-swallowing, **552**
Albers-Schonberg's disease, **586**
Albumen water, 61
Albuminuria, **354**
Alimentary :
  system, diseases of, **170**
  tract, foreign bodies in, **679**
Alkalosis, **326**
Alkaptonuria, **355**
Allenbury's No. 1 Food, 57
  No. 2 Food, 57
  No. 3, 61
Alopecia, **516**
Ambrosia :
  half cream, composition, 51
  humanized, composition, 52
  full cream, 50
Amentia, primary and secondary, 579
Amies, C. R. :
  test for chicken-pox, 398
  test for smallpox, 400
Ammoniated mercury ointment, 701
Anæmia, **305, 687**
  acquired hæmolytic, **308**
  anhæmopoietic, **306**
  aplastic, 307
  due to erythropoietic disturbances, **305**
  due to hæmolysis, **308**
  due to hæmorrhage, **307**
  due to lack of liver principal, **306**
  in acholuric jaundice, **308**
  in icterus gravis, **308**
  of new-born, **135**
  sickle-cell, **308**
Anæsthesin ointment, 702
Anæsthetic powder, 704
Anaphylactic shock, 721
Angiomata, cavernous, **525**
Angio-neurotic œdema, 497
Anhidrosis, **515**
Ankyloblepharon, **637**
Annular centrifugal erythema, **465**
Anodynes, **690**
Anorexia nervosa, **569**
Antipeol, 701
Anti-pyretic mixtures, **697**
Antiseptic :
  lotions, **704**
  powder, 704
Anti-spasmodics, **689**
Antuitrin ' S,' 373

Anus :
fissure of, **219**
fistula of, **220**
prolapse of, **220**
Aortic :
regurgitation, **288**
stenosis, **288**
Appendicitis :
acute, **203**
chronic or relapsing, **204**
Arachno-dactyly, 600
Arteries, diseases of, **300**
Arteritis, **301**
Arthritis, **609**
gonococcal, **611**
rheumatoid, **611**
syphilitic, **610**
tuberculous, **609**
Ascaris lumbricoides, **216**
Asphyxia :
livida, **128**
neonatorum, **127**
pallida, **130**
Asthma, **263**, 689
thymic, **365**
Astigmatism, **651**
Astringent mixture for diarrhœa, 693
Astrocytoma, 545
Atebrin in malaria, 450
Auditory meatus, external :
foreign bodies in, **658**
furunculosis of, **657**
herpes of, **657**
inflammation of, **656**
wax in, **658**
Axial-myopia, **650**

Bacilluria, **351**, **698**
Bacterium fœtidum, 513
Balanitis, **335**
Baldness, **516**
Ballast (food), 74
Bananas, digestibility of, 73
Bancroft, on tannic acid treatment, 675
Barley water, composition, 61
Bazin's disease, **465**, 490
Bednar's ulcers, **173**
Bee stings, **676**
Beef tea, composition, 61
Bemax, 91
Benger's Food, 61
— preparation of, 709
Bestiality, **569**
Bicarbonate of soda solution, preparation of, 717
Bickiepeg broth, 63, 709
Biliousness, **224**
Binet-Simon mental tests, 581
Birth injuries, **147**
Birth palsies, **152**
Birthmark, strawberry, **525**
Bismuth, **692**
— and ichthyol cream, 700
Bites, **676**
Blackheads, **509**
Bladder, abnormalities of, **332**
Blastophthoria, 449
Blepharitis, **637**
seborrhœic, **638**
ulcerative, **638**
Blepharospasm, **550**
Bliss's Cure, 689
Blood :
cells, abnormalities in red, **304**
— — — white, **309**
citrated, 713
diseases of, **304**
plasma, abnormalities of, **316**
platelets, abnormalities of, 311
transfusion, **711**
vessels, diseases of, **300**
Body louse, 473
Boils, **480**
Bone and vegetable broth, 61, 708
Bone :
fractures of, at birth, **149**
malignant tumours of, **608**
syphilitic diseases of, **604**
tuberculous diseases of, **603**
tumours of, **606**
Borden's Eagle Brand Milk, 54
Evaporated Milk, 55
Bornholm disease, **424**
Boro-chloretone dusting powder, 704
Bottle, feeding, **34**
— I.W.C., 35
Bowel, hæmorrhages from, **669**
Bow-leg, **620**
Boys, exercises for, 628
Brachial paralysis of new-born, **152**
Brain :
tumours of, **545**
water on, **530**

Bray, G. W., on dietetic treatment of urticaria, 494
Bread jelly, 61
Breakfast, for children, **79**
Breast milk :
collecting glasses for, **24**
composition of, **18**
deficient supply of, **22**
excessive supply of, **23**
Breast feeding, **14–32**
— and constipation, 29
— and diarrhœa, **28**
— and onset of menstruation, **27**
— and vomiting, **29**
— contra-indications for, **20**
— difficulties in, **20–9**
— establishment of lactation, **14**, 17
— frequency in, 15
— quantity at each feed, 16
— sucking, difficulties connected with, **27**
— weaning, 30
Breath holding, **556**
Brestol, 60
Bright's disease, 340
Bromhidrosis, **513**
Bromine hormone, 371
Bronchial glands, involvement in whooping-cough, 419
tubes, diseases of, **256**
Bronchiectasis, **261**
Bronchitis :
acute, **256**
capillary, **267**
Broncho-pneumonia, **267**, 675
in whooping-cough, 419
Broth, bone and vegetable, 61, 708
Browne, B., blood transfusion apparatus, 711
Buginaria, 703
Bulgolac, 695
Bunions, **522**
Burns, **673**
Burt's mental tests, 581
Buttocks, sore, 168, 456

Calamine ointment, 701
Calcium :
colloidal, with ostelin, 706
deficiency, **107**
gluconate, 706
Callosities of the skin, **522**
Calmet-le-Guerin (B.C.G.) method of inoculation, **274**, **438**
Caloric :
requirement at different ages, **113**
value of foods, 76
Campolon, 707
Canal of Nück, 145
Cancrum oris in measles, 395
Cane sugar, **58**
Canities, **518**
Capsolin, 702
Caput succedaneum, **148**
Carbohydrate :
deficiency, symptoms due to, **106**
excess, symptoms of, **116**
requirement at various ages, **116**
in children's food, 67
insoluble, **59**
uses of, 8
Carbon arc lamp, 102
Cardiac :
failure in diphtheria, 415
œdema, **297**
Carditis, acute, **283**
Carlsbad powder, effervescent, 694
Carminative mixture, 692
Cataract, 363, **648**
Catarrhal infections of new-born, **155**
Central nervous system, degenerative diseases of, **546**
Cephalhæmatomata, **148**
Cerebral :
complications in whooping-cough, 419
nerve cells, degeneration of, 649
tumours, intra-cranial, **545**
Cerebro-spinal fever, **426**, **540**
Cheeks, red, 455
Cheiro-pompholyx, **504**
Chest :
funnel, **594**
pigeon, **595**, **634**
Chewing the cud, **553**
Chicken-pox, **397**
Chilblains, **462**
ointment for, 702, 703
Children :
feeding of, **64**
quantity of food required, 75
Choking, **680**

Cholesteatoma, in the middle ear, **663**
Chondro-dystrophia fœtalis, **586**
Chorea, Sydenham's, **573**
Choreic movements, **572**
Choroiditis, **648**
Chvostek's sign, 363
Cisternal puncture, **725**
Citric acid milk, 44
Clavicle, fracture at birth, **151**
Claw foot, **619**
Cleft palate, **28, 598**
Cleido-cranial dysostosis, **587**
Cod-liver-oil emulsion, 61
Cœliac disease, **206**
Cold, common, 242
— of new-born, **155**
Coli bacillus infections, **451**
Collecting glasses or shells, **24**
Coloboma of eyelid, **637**
Colon, congenital idiopathic dilatation, **201**
Colonic irrigation, Plombière method, 194
Colostrum, 14
Comedones, **509**
Concussion, **667**
Conduct, disorders of, **569**
Condylomata, 461
Conjunctival sac, foreign bodies in, **677**
Conjunctivitis, **640**
acute, **641**
chronic, **641**
follicular, **641**
in measles, 394
phlyctenular, **643**
swimming bath, 641
Constipation, **194, 693**
in breast-fed infants, **29**
Convalescent serum in measles, 392
Convulsions, **556**
due to acute infections, **559**
due to cerebral œdema, **559**
due to cerebral tumours, **559**
due to dentition, **559**
due to encephalitis, **559**
due to meningitis, **559**
due to tetany, **559**
infantile, **557**
Coramine, 687
Cord :
hernia of, 142
Cord, paralysis of, **250**
webbing of vocal, **245**
Cornea :
foreign bodies in, **677**
opacity of, **646**
rabbits, transplantation of, **646**
ulceration of, **645**
Corneitis, **645**
Corns, **521**
plantar, **522**
Corona seborrhœica in pityriasis, 483
Corticotropic hormone, 371
Cortin, 367
Corti's membrane, disease of, **665**
Corynebacterium, 410
Coryza, **229**
Cough :
barking, 249
mixtures, **688**
syrups, **688**
Cow and Gate :
full cream, composition, 50, 57
half cream, composition, 51, 57
humanized, composition, 52, 57
lactic acid milk, 57
Cow's milk, **36** *et seq.* (*see also* Milk)
Coxa vara, **602**
Crabs, 473
Cream, **39**
bismuth, **692**
Marylebone, 60
New Zealand, 60
thick, 61
thin, 61
university, 60
vitroleum, 60
— composition of, 61
synthetic, **60**
Creosote, 696
treatment for tuberculosis, **276**, 441
Cretinism, **359, 583**
Croup, spasmodic, **247**
Crowing, **555**
Cruickshank, F. G., cause of mongolism, 582
J. N., on œdema of brain, 139
Crying :
constant, **555**
uncontrolled, **569**
Cryptorchidism, Antuitrin 'S' treatment in, 336

Cuts, **669**
Cyanosis :
in heart disease, 297
of new-born, **126**
Cyprus fever, **423**
Cystazal, 698
Cystinuria, 351, **355**
Cystitis, **332**
Cysts :
dermoid, 598
of bone, **606, 607**

Dactylitis, **605**
Dakin's Solution, 705
Dandruff, **482**
Deaf-mutism, **571**
Deafness, **666**
Deficiency diseases, **85–119**
due to lack of all elements, **104**
symptoms other than those due to lack of vitamins, **103**
Dehydration fever, 126
Dental hæmorrhages, **669**
Dentition, inflammation during, **171**
Desensitization :
gradual method, 722
ingestion method, 722
massive method, 721
of hypersensitized child, **720**
Dettol, 705
Devil's grip epidemic, **424**
Dextrose, tolerance test, 719
Diabetes :
insipidus, **383**
mellitus, **375**
neurogenous, **375**
Diabetic children, caloric requirements, 376
— calorie value of suitable foods, 379
Diaphoretic mixture, **697**
Diarrhœa, **192**, 323, **692**
in breast-fed infants, **28**
Dick test, 385, 387
toxin, 387
Diet :
ketogenic, 325
sheets for children (1 to 5 years), **78**
— — — (1 year), **80**
— — — (5 years), **81**
Digestibility of food, 72
Digestion, **10**
Digestive mixtures, **691**
Dinners for children, **81**
Diphtheria, 247, **410**
cardiac failure in, 415
desensitization, 414
laryngeal, 414
streptococcal infection in, 415
treatment of carriers, 412
Dirtiness, **569**
Dischiasis, **637**
Dislocations, **676**
Diuretic :
drugs, 341
mixture, **697**
Dosage of drugs for children, **685**
Dried milks, **49** *et seq.* (*see also* Milk)
Drinker, respiratory apparatus, 430
Drip method of transfusion, 715
— apparatus, 716
Duke's disease, **396**
Duodenal ulcers, 675
Dusting powders, 704
Dwarfism, renal, **344**
Dyshidrosis, **504**
Dyspnœa, **296**

Ear :
cap, 654
cholesteatoma in, **663**
diseases of, **654**
drops, 706
granulations of, **663**
outstanding, **654**
polypi of, **663**
Echolalia, **571**
Ectopia testis, **336**
Ectropion of eyelids, **637**
Eczema, **498, 701**
-prurigo-asthma syndrome, 720
Embrocations, **703**
Encephalitis, **430–4, 536**
epidemic, **431**
lethargica, **431, 536**
in measles, 395
Encephalocele :
acquired, **590**
congenital, **590**
Endocarditis, **285**
Enteric fever, **404**
Entropion of eyelids, **637**
Enuresis, **344**, 556
diurnal, **345**

Enuresis, nocturnal, **346**, 698
Ephredin, 689
Epidemic :
  conjunctivitis, **425**
  encephalitis, **431**
  paralysis, **428**
  parotitis, **419**
Epilepsy, **560**
Epiphyses, separation of, **603**
Epiphysitis, **603**
Epispadias, **333**
Epistaxis, **315**, **668**
Equivalents of Imperial and Metric dosage, **686**
Erb's sign, 363
Ergosterol, irradiated, A.T. 10, 364
Erysipelas, **486**
Erythema :
  circinatum, **465**
  due to infective fevers, **463**
  induratum, 490
  — scrofulosum, **465**
  infectiosum, **396**
  multiforme, **463**
  nodosum, **464**
  of drug origin, **463**
  pernio, **462**
  simple, **456**
Erythœdema polyneuritica, **91**
Eucalyptus and boracic acid ointment, 700
Eunuchoidism, **373**
Exanthema subitum, **397**
Exanthems, acute, **385** *et seq.*
Excess diseases, 112
Exophthalmic goitre, **358**
Exostoses, **607**
Extractives :
  in children's food, 72
  uses of, 9
Eye :
  diseases of, **637**
  drops for, 706
  foreign bodies in, **677**
Eyestrain, 651

Facial paralysis of new-born, **152**
Fæcal fistula, 143
Fat :
  deficiency, symptoms due to, **105**
  excess, symptoms of, **118**
  in children's food, 68
Fat requirement at various ages, 118
  uses of, **7**
Favus, **476**
Fecto, 705
Feeble-mindedness, 579
Feeds, thickened, 553
Feeding :
  artificial, 33 *et seq.* (*see also* Artificial)
  bottle, **34**
  — I.W.C., 35
  breast, **14** *et seq.* (*see also* Breast)
  children (1 to 5 years), **64–84**
  — times of, 77
  infants, times of, **11**, 14, 16
  complementary, **18**
  principles of physiological, **1**
  psychological aspect, 77
  supplementary, **18**
Feeds, frequency of, **11**, 14, 16, 77
Feer's disease, **91**
Fell, H. B., on bone growth, 150
Femur, fracture of, at birth, **149**
Fibro-cystic disease, **607**
Fibrosis, pulmonary, **261**
Fifth disease, **396**
Filatow-Duke's disease, **396**
Fingers :
  clubbing of, **605**
  drumstick, **605**
  Hippocratic, **605**
Flannel rash, **483**
Flat foot, **617**
Food :
  excesses, symptoms of, **112**
  refusal of, **569**
  sterilization of, **12**
  total quantity required, 75
Foods :
  caloric value of, 76
  fuel, **5**
Foot :
  claw, **619**
  drill, **619**
  flat, **617**
Foreign bodies :
  in alimentary tract, **679**
  in ear, **658**, **678**
  in eye, **677**
  in larynx, **680**
  in nose, **678**
Fourth disease, **396**

Fox, Tilbury, contagious impetigo of, **484**
Fractures in the new-born, **676**
Fragilitas :
  crinium, **518**
  ossium, **605**
Franklin, P., deafness in children, 666
Frew, R. S., on cause of cerebral hæmorrhage, 558
  on hæmorrhagic disease, 138
Fröhlich syndrome, 372
Fuel requirements of baby, **5**
Functional :
  diseases of nervous system, **547**
  neuroses, spasmodic, **549**
Funnel chest, **594**
Furunculosis, **480**

Galactagogue hormone, 371
Galactose tolerance test, 719
Gambusia, 449
Gas gangrene anti-toxin, 671
Gastritis, **173**
  acute, **174**
  chronic, **174**
Gastro-enteritis :
  acute, **189**
  in burns, 675
Gavage, **724**
Genito-urinary system, diseases of, **330–55**
Genu valgum, **621**
  varum, **620**
German measles, **395**
Gibraltar fever, **423**
Girls, exercises for, 626
Glandular fever, **422**
Glaxo :
  full cream, composition, 50, 57
  half cream, 57
  Sunshine, composition, 51, 57
Glioma of retina, 649
Glucose, **59**
  in hyperinsulinism, 383
  solution, preparation of, 717
  tolerance test, 719
Glycosuria, transient, 375
Gnat bites, **677**
Goat fever, **423**
Goitre, **357**
  exophthalmic, **358**
Gonadotropic hormone, 371
Gonads, abnormalities of, **373**
Granuloma annulare, **466**
Grave's disease, **358**
Greenosan, 707
Growth hormone, 371
Gum :
  rash, **492**
  red, 460
Gunshot wounds, **671**

Hæmatemesis, **668**
Hæmatoma of sterno-mastoid muscle, **149**
Hæmaturia, 340, **354**
Hæmoglobinuria, **354**
Hæmolac, composition, 50
Hæmophilia, 313
Hæmoptysis, **668**
Hæmorrhages, **667**
  traumatic, of new-born, **153**
Hæmorrhagic disease of new-born, **137**
Hæmorrhoids, **219**
Hair :
  brittleness or splitting of, **518**
  diseases of, **516**
  excessive growth of, **518**
  pulling, **552**
  whitening of, **518**
Hallux varus, **619**
Hammer toe, **620**
Hare-lip, **28, 598**
Harris, L. S., on vitamin C deficiency, 94
  vitamin D requirements, 98
Harrison's grove, **635**
Hartmann's solution, preparation of, 717
Harvest bugs, 471
Hay fever, **237, 690**
Headache, **562**
Head :
  louse, **472**
  nodding, **551**
Heart :
  block, **299**
  disease, congenital, **282**
  — cyanosis in, **297**
  — liver enlargement in, **298**
  diseases of, **282–300**
  failure, **293**
Hendon's needle, 715
Hepatex, 687
Hernia :
  abdominal, in new-born, **145**

Hernia, inguinal, in new-born, **145**
irreducible, in new-born, **146**
of cord, 142
Herpes :
femoralis, 460
recurrent, 460
simplex, **466**
zoster, **467**
Hexyl-resorcinol, 699
Hill, Gardener, on hyperpituitarism, 371
Himrod's powder, 689
Hip, congenital dislocation of, **614**
Hirschsprung's disease, **201**
Hoarseness, 249
Hollandia milk, 54
Hoos albumen milk, 61
Hordeolum :
externum, **638**
internum, **638**
Horlick's malted milk, 61
Hormones, **367, 371**
Humerus, fracture of, at birth, **149**
Hydroceles, congenital, **147**
Hydrocephalus, **530**
author's treatment, **532**
Hydro-nephrosis, **331**
Hydro-ureter, **330**
Hygroma, 598
Hyper- :
-chlorhydria, **115**
-genitalism, **373**
-glycæmia, **375**
-gonadism, **373**
-hidrosis, **514**
-insulinism, **382**
-metropia, **649**
-nephromata, **369, 608**
-parathyroidism, **362**
-phlebæmia, 138
-phlebœmia, 558
-pituitarism, **371**
-telorism, **589**
-thyroidism, **357**
-trichosis, **518**
Hypo- :
-chlorhydria, 215
-gonadism, **373**
-parathyroidism, **363**
-pituitarism, **372**
-spadias, **332**
-thyroidism, **359**
Hysteria, **576**
Icterus gravis, 131, 132, **133**
— anæmia in, **308**
neonatorum, **131, 132**
Ideal milk, 55, 57
Idiocy, 579
amaurotic family, 649
Idioglossia, **571**
Ignis sacer, **467**
Imbecility, 579
Impetigo :
contagiosa, **484**
of Bockhart, **479**
vulgaris, **484**
Inanition fever, **126**
Infant feeding :
miscellaneous preparations, **60**
with proprietary preparations, **55**
Infantile :
osteosclerosis, **586**
paralysis, **428**
scurvy, **94, 172**
Infantilism, renal, 344
Infections of new-born, **154**
Infectious diseases, **385–454**
Infective mononucleosis, **422**
Influenza, **408**
convalescent serum for, 409
of new-born, **155**
Injuries, birth, **147**
Insomnia, **565**
Insulin, **374**
shock, **380**, 382
zinc protamine, 380
Internal secretions, **374**
Intestinal :
obstruction, acute, **200**
toxæmia, **223, 695**
Intra-cranial :
abscesses, **544**
hæmorrhage of new-born, **153**
pressure, increased, 139
Intra-peritoneal injections, 713
Iodine :
deficiency, 110
substances containing, 111
Iodized phenol, 706
Iodoform paint, compound, 702
Irido-cyclitis, 646
Iritis, **647**
Iron deficiency, 109
Irradiation, natural and artificial, 100, 101
Ischio-rectal abscess, **220**

Itch, **470**

James, J. F., prophylactic treatment of malaria, 449
Jaws :
  deformities of, **600**
  exercise of, 73
Jaundice, **225**
  acholuric, anæmia in, **308**
  catarrhal, **226**
  due to obliteration of bile ducts, 131, 132, **134**
  due to sepsis, 131, 132, 134
  due to syphilis, 131, 132, **134**
  hereditary acholuric, 131, 132, **135**
  obstructive, 225
Joints, diseases of, **585, 614**

Kaleni of Hebra, spiritus saponis, 509
Kaolin, 215
Kaylene-ol, 215
Keratitis :
  interstitial, **646**
  punctata, 646
  superficial, **645**
Ketogenic :
  diet, 325
  treatment of epilepsy, **562**
Ketosis, **324**
Kidney :
  decapsulation of, 342
  diseases of, **336**
  large white, **340**
Klebs-Löeffler bacillus, 410
Klippel-Feil's disease, **592**
Knock knee, **621**
Koch's old tuberculin, inoculation with, 439
Koch-Weeks bacillus, 425, 641, 643
Kolmer serum-optochin treatment of pneumococcus meningitis, 541
Koplick spots, 392, 398
Kyphosis, **633**

Labyrinthitis, **665**
Lachrymal :
  abscesses, **639**
  sac, inflammation of, **640**
Lactation, establishment of, **14**, 17
Lactic acid milk, **44**, 57, 695
Lactobacilline, 695
Lactogen, composition, 52
Lactose, caloric value of, 61
Lævulose tolerance test, 720
Lalling, **571**
Laryngeal :
  diphtheria, obstruction in, 414
  spasm, **247**
  stridor, congenital, **245, 249**
Laryngismus, stridulus, 248, **556**
Laryngitis :
  acute, **246**
  — catarrhal, **246**
  — membranous, 247
  chronic, **249**
  spasmodic, **247**
  stridulosa, **247**
  syphilitic, **250**
  tuberculous, **250**
Larynx :
  acute œdema of, **251**
  angio-neurotic œdema of, **252**
  diseases of, **245–53**
  foreign bodies in, **250, 680**
  new growths of, **253**
  scorbutic ecchymosis of, 252
Lauries dropper, 711
Lavage, **723**
Lederle's extract of liver, 707
Left-handedness, **571**
Leucopenia, **309**
Leontiasis ossea, **605**
Leptus autumnalis, **471**
Leucocyte count, variations in, 310
Leucocytosis, **309**
Leucotrichia, **518**
Leukæmia, **310**
Lice, **472** *et seq.*
Lichen :
  annularis, **466**
  planus, **506**
  urticatus, 460, **492**
Liniments, **703**
Lip, hare, **28**
Lipiodal method of outlining bronchial tree, 726
Lip-tie, **170**
Lisping, **571**
Lithiasis, 350
Liver :
  diseases of, 222
  enlargement of, 225
  — in heart disease, **298**

Liver extracts, 707
inefficiency, 224
spots, **476**
Lobar-pneumonia, **270**
L'œuvre Grancher system, 436
Long-sight, **649**
Lordosis, **633**
Lorenz's manipulation of dislocated hip, **614**
Lotions, antiseptic, 704
Lying, **569**
Lymphangiomata, 598
circumscribed, **526**
Lumbar puncture, **724**
Lung :
abscess of, **276**
gangrene of, **277**
Lupus vulgaris, **488**

Magnesia, cream of, 695
Malaria, **448**
congenital, 448
malignant, 448
quartan, 448
subtertian, 448
tertian, 448
Malassez bottle bacillus, 482
Malt sugar, **58**
Malta fever, **423**
Manganese, collosol, 706
Mantoux test, 440
Marble bone, **586**
— disease, 362
Marmite, 91
Martiny treatment of mumps, 421
Mastoid disease, **663**
— complications of, **665**
Masturbation, **554**
Mayou, Sheila, on Orthoptic training, 653
Mead's Protein milk, 61
Measles, **391**
complications of, 394
German, **395**
Meat juice, raw, composition, 61
Meckel's diverticulum, **143**
— foreign bodies in, **679**
Mediterranean fever, **423**
Meibomian glands :
abscesses, **639**
conjunctivitis, **642**
Melæna, **669**
Melanophore hormone, 371
Mellin's Food, 61
Meningismus, **544**
Meningitis, **538**
influenzal, **541**
meningococcal, **540**
of mumps, 542
pneumococcus, **541**
serous, **543**
staphylococcus, **540**
streptococcic, **540**
syphilitic, **543**
tuberculous, **538**
Meningococcal meningitis, **426**, 532
Menstruation in nursing mother and breast feeding, **27**
Mental deficiency, **578**
Menthol liniment, 703
Mercuric oxide ointment, yellow, 702
Merrill-Palmer mental tests, 581
Merycismus, **553**
Metabolic hormone of adrenals, 367, 371
Micromelia, **586**
Microspora (ring-worm), 474
Midge bites, **677**
Migraine, **564**
Milk :
accredited, **38**
ass's, **47**
breast, 18 (*see also* under Breast)
buffalo's, 47
Certified, **37**
Certified Tuberculin Tested, **38**
citrated, **45**
composition from different animals, **47**
condensed, **53**
— sweetened, 53
— unsweetened, 54
cow's, composition, 61
— modifications of, **36**
dried, **49**
— composition of full-cream, **50**
— full cream, 57
— humanized, **51**, 57
evaporated, **55**
fever, 16
goat's, **48**
grade A, **37**
— (Tuberculin Tested), **37**
graded, **37**
human, composition, 61

Milk, mare's, **48**
modification, methods of, **39**
— citrated method, **45**
— citric acid method, **44**
— half and half method, **39**
— lactic acid method, **44**
— split protein method, **40**
— top milk method, **42**
— whole milk method, 46
Pasteurized, 37, **38**
peptonized, 709
skin, composition, 61
sour, **44**
sugar, **58**
Tuberculin Tested, **37**
— — (Pasteurized), **38**
whole, method of artificial feeding, **46**
Milkmaid Brand Milk, 54
Minadex, 63
Mineral :
depletion, **696**
elements in children's food, 69
Minerals, uses of, **9**
Mirror-writing, **572**
Mistura :
pertussis, 690
tussis infantalis, 688
Mitral :
regurgitation, **286**
stenosis, **287**
Mocassin snake venom, 315
Moles, **527**
Molluscum contagiosum, **523**
Moncrieff, A. on œdema of brain, 139
Mongolism, **581**
Monsol, 705
Morax-Axenfeld bacillus, 425, 641
Morbilli, **391**
Morphœa, **519**
Mosquito :
anopheline, 448
bites, **677**
Multivite pellets, 63
Mumps, **419**
meningitis of, 542
Murphy drip, 715
Muscles, diseases and deformities of, **615–636**
Muscular dystrophies, 546
Myocarditis, **289**
Myopathies, **546**
Myopia, **650**
Myositis acuta epidemica, **424**
Myringotomy, 661
Myxœdema, **359**

Nævi, **524**
capillary, **524** *et seq.*
cavernous, **525**
fibromatous, **527**
lymphatic, **526**
vascular, **524**
Nail-biting, **552**
Nails :
diseases of, **527**
ring-worm of, **476**
Napkin rash, **458**
Narcotics, **690**
Nares, congenital atresia of the posterior, **232**
Nasal :
bougies, 703
feeding, **724**
polypi, **237**
Neal and Bentley, treatment of encephalitis, 537
Neaves' Food, 61
Neo-hepatex, 707
protosil, 705
Nephritis :
chronic interstitial, **342**
glomerular, **337**
in scarlet fever, 390
parenchymatous, **340**
tubular, **340**
Nephrosis, **340**
chronic, **342**
Nervous :
child, **547**
system, diseases of, **530–584**
— functional diseases, **547**
Nestlé's Milk, 54, 57
Neumann-Neurode exercises, 577, 624
Neurasthenia, 577
Neuro-fibromatosis, 547
Neuroses, spasmodic functional, **549**
New-born baby, **120–169**
cyanosis of, **126**
Night terrors, **567**
Nipple :
artificial, **35**
cracked or sore, **25**
retracted, **24**

Nipple, shield, **25**
Nirvanol treatment of chorea, 575
Nocturna enuresis, **698**
Noise-making habits, **554**
Nose :
  bleeding, **668**
  congenital defects of, **232**
  diseases of, **232–237**
  foreign bodies in, **678**
  picking, **552**
Nutritional diseases due to dietetic faults, **85–119**
Nutritive salts, 696

Œdema of brain, 139
Œsophagus, abnormalities of development, **173**
Œstrin, 373
Œzena, **235**
Ointments, 700
Oleate of thorium, 702
Omphalo-mesenteric fistula, 142
Onychia, infective, **528**
Onycho-mycosis tricophyta, **476**
Ophthalmia neonatorum, **160**
Optic atrophy, 649
Organon, 99
Osteogenesis imperfecta, **585**
Ostelin, 99
Ostermilk 1 :
  composition, 51
  humanized, composition, 52, 57
Ostermilk 2, composition of, 50
Osteomyelitis, **602**
Osteopetrosis, **586**
Osteosclerosis fragilis generalizata, **586**
Otitis media, **659**
  — acute, **660**
  — chronic, **661**
  — complications of, **665**
  — in scarlet fever, 391
Otorrhœa, 661
Overlapping toes, **620**
Oxycephaly, **588**
Oxygen inhalations, **722**
Oxytocin (Pituitary), 371
Oxyuris vermicularis, **217**

Palate :
  cleft, **28, 598**
  deformities of, **599**
  malformations of, **599**
Palsies, birth, **152**
Pancreas, **374**
Pancreas, diseases of, **227**
Pancreatic insufficiency, **227**
Pancreatitis :
  acute, **227**
  chronic, **227**
Pancreatotropic hormone (Pituitary) 371
Papillœdema, 649
Paralysis of new-born, **152**
Paraphimosis, **334**
Parathyroid glands, diseases of, **361**
  tetany, **363**
Parathyrotropic hormone (Pituitary), 371
Paratyphoid, **407**
Parrot disease, **421**
Paroxysmal tachycardia, **300**
Pastry, suitability for children, 73
Pavor nocturnus, **567**
Pediculosis :
  capitis, **472**
  corporis, 473
  palpebrarum, 473
  pubis, 473
Pemphigus :
  acutus, **469**
  chronicus, **469**
  foliaceus, **470**
  vegetans, **470**
Penis :
  abnormalities of, **333**
  malformations of, **332**
Pericarditis, **291**
  suppurative, **292**
Peripheral nerves, diseases of, **546**
Peritonsillar abscess, 244
Pertussis, **415**
Pes cavus, **619**
Petroleum emulsion, 693
Petrolgar, 693
Pharyngitis : **238** *et seq*
  acute, **238**
  septic, 238
  simple, 238
  chronic, **239**
Phimosis, **333**
Phlebitis, **302**
Phosphaturia, 351
Phosphorus :
  deficiency in infant feeding, 108
  prescriptions for, 699
Physiological feeding, principles of, **1**

Pigeon chest, **595, 634**
Pigeon toe, **619**
Pigments, **702**
Pineal gland, **374**
Pink disease, **91**
  eye, **425,** 641
Pinna :
  hæmatoma of, **655**
  inflammation of, **656**
  perichondritis of, **655**
Pituitary :
  gland, diseases of, **370** *et seq.*
  lobes, hormones of, **371**
Pityriasis, **482**
  circinata, **483**
  versicolor, **476**
Plasmoquine in malaria, 450
Pleurisy, **277**
  abortive, 425
  tuberculous, **281**
Pneumonia :
  alveolar, **270**
  broncho, **267**
  catarrhal, **267**
  croupous, **270**
  lobar, **270**
  lobular, **267**
Poisons and their antidotes, **680**
Polio-encephalitis, **428, 432**
  encephalo-myelitis, **428**
Poliomyelitis, **428**
Politzer method of inflating middle ear, 662
Polypi :
  nasal, **237**
  of ear, **663**
Pompholyx, **504**
Porphyrinuria, **355**
Porrigo :
  favosa, **476**
  lupinosa, **476**
Posseting, **553**
Powders, **704**
Pregl's concentrated iodine solution, 718
  — — treatment of pneumococcus meningitis, 541
Premature baby :
  care of, **120**
  feeding, **122**
  feeding bottle and teat, **124**
  inanition fever, **126**
  initial loss of weight, **125**
Progestin, 373
Prognathism, **600**
Prolan A and B, 371, 373
Prontosil, 699
Proprietary preparations in infant feeding, 55
Protein :
  deficiency, symptoms due to, **104**
  excess, symptoms of, **114**
  in children's food, 65
  uses of, **6**
Psittacosis, **421**
Psoriasis, **505**
Psychological aspect of feeding, 77
Ptosis, **637**
Puberty, precocious, **373**
Purpura, **311**
Pustular perifolliculitis, superficial, **479**
Pyæmia, 403
Pyelitis, **698**
Pyloric stenosis, congenital hypertrophic, **178**
Pyo :
  nephrosis, **331**
  pericardium, **292**
  ureter, **330**
Pyuria, **351**

Quartz mercury vapour lamp, 102
Quino-plasmoquine in malaria, 450

Radiostol, 99
Radiostoleum, 99
Ramsay, F. B., on continuous saline transfusion, 715
Ranula, **170**
Ray fungus, 442
Raynaud's disease, **302**
Rectal polypus, **218**
Rectum, prolapse of, **220**
Refraction, errors of, **649**
Regurgitation, **185**
  aortic, **288**
  mitral, **286**
  pulmonary, **289**
  tricuspid, **289**
Resorcin ointment, 701
Respiratory system, diseases of, **229–81**
Retina, miliary tuberculosis of, 649
Retinitis, syphilitic, 649

Rheumatic chorea, **573**
Rheumatism, **444, 691**
in scarlet fever, 391
Rhinitis :
acute, **229**
atrophic, **234**
— fœtid, **235**
catarrhal, **229**
chronic, **233**
— hypertrophic, **233**
gonococcal, **231**
syphilitic, **231**
Rickets, **96** *et seq.*
renal, **344**
Rickets' 'sign of the axilla' for chicken pox, 398
Ridge's Food, 61
Ringed eruption, **466**
Ringer's solution, preparation of, 717
Ring-worm, 474
of nails, **476**
Roboleine, 63
Rock fever, **423**
Roller process of drying milk, 49
Rosenow's pleomorphic streptococcic serum, 433
Roseola infantum, **397**
Röthlen, **395**
Roughage, 7, 74
Round shoulders, **624**
worms, **216**
Rubella, **395**
Rubeola, **395**
Rumination, **185, 553**
Rumpel-Leede phenomenon, 726
Russell's viper venom, 315

Sabouraud's micrococcus cutis communis, 482
staphylococcus, 478
Saline :
normal, preparation of, 717
transfusion, **714**
— continuous, 715
— — apparatus for, 716
Salines, 694
Salts :
in children's food, 69
mixed, 696
Sauerin, 695
Savory and Moore's Food, 61
Scabies, **470**
Scalds, **673**
Scalp, pityriasis of, **482**
Scaphocephaly, **589**
Scapula, congenital elevation of, **593**
Scarlet fever, **385**
— complications, 390
Schick test, 411
Schultz-Charlton test :
in chicken-pox, 398
for scarlet fever, 386, 395
Sclerema, **520**
Sclerodermia, **519**
circumscribed, **519**
Sclerosis, renal, **342**
Scoliosis, **631**
Scott, S. G., on diagnosis, of rheumatism, 445
Scrofuloderma, **489**
Scurf, **482**
Scurvy, infantile, **94**, 172
Seborrhagia, **508**
Seborrhœa, **508**
Sedatives, **690**
Seller's treatment of morphœa, 519
Sepsis, **402**
Septic infections of new-born, **166**
Septicæmia, 402
Septum submucous resection of, **232**
Serum sickness in scarlet fever, 391
Shingles, **467**
Short-sight, **650**
Shoulder, Sprengel's, **593**
Shoulders, round, **624**
Sigmoid sinus, thrombosis of, **665**
Sinusitis, 235
acute, **235**
chronic nasal, 236
Sister Laura's Food, 61
Sixth disease, **397**
Skeletal system, diseases of, **585–614**
Skin :
actinomycosis, of, 477
callosities, of, **522**
diseases of, **455–529**
— due to syphilis, **490**
— of new-born, **167**
glabrous, pityriasis of, **483**
greasiness of, 509
injury at birth, **147**
irritability in measles, 395
miliary tuberculosis of, **489**

Skin, septic, **701**
tuberculous affections of, **487**
Skull :
bones, fracture of, at birth, **149**, 667
fracture of base, 667
Sleep :
disorders of, **565** *et seq.*
walking, **568**
Sleepiness, excessive, **566**
Sleepy sickness, **537**
Smallpox, **399**
Smith, Jean, on cause of clubbing of fingers, **606**
Snake :
bites, **677**
venom, 315
Snuffles, **231**
Soaps, medicated, **704**
Somnambulism, **568**
Somnolence, 374, 566
Soxhlet sterilizer, 13
Spasmophilic conditions, 699
Spasms, histrionic, **550**
Speech, disorders of, **571**
Spina bifida, **536**, **591**
Spinal cord, injury to at birth, **152**
Spitefulness, **569**
Spotted fever, **426**
Sprains, **675**
Spray process of drying milk, **49**
Sprengel's Shoulder, **593**
Squint, **652**
concomitant convergent, **652**
— divergent, **653**
paralytic, **653**
St. Anthony's Fire, **486**
Stammering, **571**
Staphylococci, skin diseases due to, **478**
Staphylococcus, pyogenes albus and aureous, 478–81
Staphyloma, anterior, 645
Status lymphaticus, **366**
Stealing, habit of, **569**
Steam tent, 723
Steatorrhœa, **205**
Steeple skull, **588**
Stenosis, aortic, **288**
mitral, **287**
pulmonary, **289**
tricuspid, **289**
Still's disease, **611**
Stings of insects, **676**
Stomach, dilatation of, **175**
Stomachic mixture, 692
Stomatitis, **171**
Stools : 192 *et seq.*
frothy, 214
loose, **192**
Strabismus, **652**
Stramonum powder, 689
Staphyloma, **646**
Streptococcal infection in diphtheria, 415
Streptothrix actinomyces, 443
Strophulus, 460, **492**
Stuttering, **571**
Styes, external, **638**
internal, **639**
Styptic collodion, 703
Subcutaneous injection of fluid, 714
Sucking, difficulties connected with, **27**
Sudorrhœa, **512**
Sugar :
cane, **58**
malt, **58**
milk, **58**
Sulcus, Harrison's, **635**
Suprarenal virilism, **369**
Sweat-glands, diseases of, **512**
Sweating, excessive, **512**
Swift's disease, **91**
Swift-Feer's disease, **91**
Sydenham's chorea, **573**
Symblepharon, **637**
Syphilis, **443** *et seq.*
congenital, in new-born, **161**
skin diseases due to, **490**
treatment of mother during pregnancy, **161**
Syringe for blood transfusion, 712
Syringomyelia, **536**

Talipes, **601**
arcuatus, **619**
Tannafax, 675
Tannic acid :
alcoholic solution of, 702
jelly, 675
treatment for burns, **674**
Tape-worms, **216**
Tar ointment, 701
Tea for children, **81**
Teething rash, 460, **492**
Temper, fits of, **569**

Terman's mental tests, 581
Test feed, 17
Testicle, undescended, **335**
Testis ectopia, **336**
Tetanus, **434**
  anti-toxin, 671
Tetany, **327, 363, 699**
Thermega electric warming pad, 121
Thigh-rubbing, **554**
Thomas, J. W. Tudor, on corneal transplantation, 646
Thorax, deformities of, **634**
Threadworms, **217**
Three day fever of Glauzmann, **397**
Thrush, 171
Thumb-sucking, **551**
Thymic asthma, **365**
Thymol, lotion, 704
Thymus, diseases of, **365**
Thyroideum siccum, 122
Thyroid gland :
  diseases of, **356** *et seq.*
  for premature babies, 122
Thrombopenia, **311**
Thyrotropic hormone (Pituitary), 371
Tibiæ, curved, 620
Tinea :
  circinata, 475
  favosa, **476**
  tonsurans, 474
  unguium, **476**
  versicolor, **476**
Toe :
  hammer, **620**
  overlapping, **620**
  pigeon, **619**
Tolerance tests, 718
Tongue-sucking, **551**
  tie, **170**
Tonics, **687**
Tonsillitis, **243**
  acute, 243
Torticolis, **615**
Tourniquet tests, 726
Tower skull, 588
Toxæmias, 402
Trachea :
  congenital malformations, **253**
  diseases of, **253**
  foreign bodies in, **255**
Tracheitis, catarrhal, **253**
Trachoma, **641**
Transient diaphragmatic spasm, **424**
Trichophyta (ring-worm), 474
Tricuspid :
  regurgitation, **289**
  stenosis, **289**
Trilactine, 695
Trophodermato-neurosis, **91**
Trousseau's sign, 363
Trufood :
  half cream, composition, 51
  humanized, composition, 52, 57
  full cream, 50, 57
Truss :
  pneumatic, 146
  wool, 146
Tuberculosis, **435**
  colonies, 437
  creosote treatment, 441
  cutis, **487**
  immunisation, 438
  in the new-born, **157**
  pulmonary, **273**
Tubular nephritis, **340**
Tungsten arc lamp, 102
Tympanic membrane, rupture of, **659**
Typhoid :
  carriers, 405
  fever, 404

Ulcera pterygoidea, **173**
Ulcers, tuberculous, **489**
Umbilical :
  hæmorrhage, **140**
  hernia, 141
  sepsis, **140**
Umbilicus :
  abnormalities of, 142
  in the new-born, **140**
Undulant fever, **423**
Urachus, persistence of, 144
Ureters, abnormalities of, **330**
Urethritis, **335, 698**
Uric acid, 169
  — and urates in urine, **350**
Urinary :
  fistula, **144**
  tract, congenital defects, **330**
  — functional disturbances, **344**
Urine :
  abnormal conditions of, **350**
  abnormalities in new-born, **169**

Urine, retention of, **349**
suppression of, **349**
Urticaria, **491**
giant, **497**
papular, **492**

Vaccination, **400**
complications of, 401
Vaccine, antityphoid paratyphoid, 405
Varicella, **397**
Variola, **399**
elementary bodies of, 400
Varnishes, **702**
Vasopressin, 371
Venoclysis, 715
Ventriculography, 532, 726
Verruca vulgaris, **522**
Viper venom, 314
Vincent's angina, 243, **244**
Viosterol, 99
Virol, 63
Visceral injuries of new-born, **154**
Visual memory, inaccuracy of, 651
Vitamin A, 62
A deficiency disease, 86
B_1 and B_2, 62
B content in various preparations, **91**
— deficiency disease, 89
C, 62
C deficiency disease, **94**
D, 62
D produced in skin by irradiation, 100
— deficiency disease, 96
— in foods, 98
— in various preparations, 99
preparations, 707
Vitamins :
in children's food, 71
uses of, **8**
Vitmar, 63
Vomiting, **176**
cyclic, **187, 322**
from food causes, **177**
habit, **184**
in breast-fed infants, **29**
von Recklinghausen's disease, **362, 547**

Ward's treatment of influenzal meningitis, 542
Warren's sweat box therapy, 575
Warts, **522**
anatomical, **490**
tuberculous, **490**
Wasp stings, **677**
Water allowance for children, 77
Wax in ear, **658**
Weaning, 30
from breast to bottle, 30
— breast to mixed dietary, 31
Web-neck, **592**
Weil-Felix test, 405
Welchii, bacillus, 671
Whey, composition, 61
Whitehead's varnish, 702
Whitfield's ointment, 702
Whooping-cough, **415, 690**
complications of, 419
Widal on undulant fever, 424
reaction, 405, 421
Williamson and Gibbons on undulant fever, 424
Winkel's disease, **354**
Witkin, M., on Sixth disease, 397
on treatment of urticaria, 496
Word blindness, **571**
deafness, **571**
Worms :
round, **216**
tape, **216**
thread, **217**
Wounds, **669**

Xerophthalmia, **644**
Xerosis, **644**

Yeast preparations, 91, 708
Yestamin, 708
Yestique, 708
Youpa-la exercise chair, **618**

Zinc :
and castor oil ointment, 700
protamine insulin, 380
Zondek on pituitary dysfunction, 383

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